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OFFSHORE OIL DEVELOPMENT

Issues and Impacts for the
Central California Coast



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FINAL REPORT

OFFSHORE OIL DEVELOPMENT

**Issues and Impacts for the
Central California Coast**

Prepared for:

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CHAPTER 1

CHAPTER 1

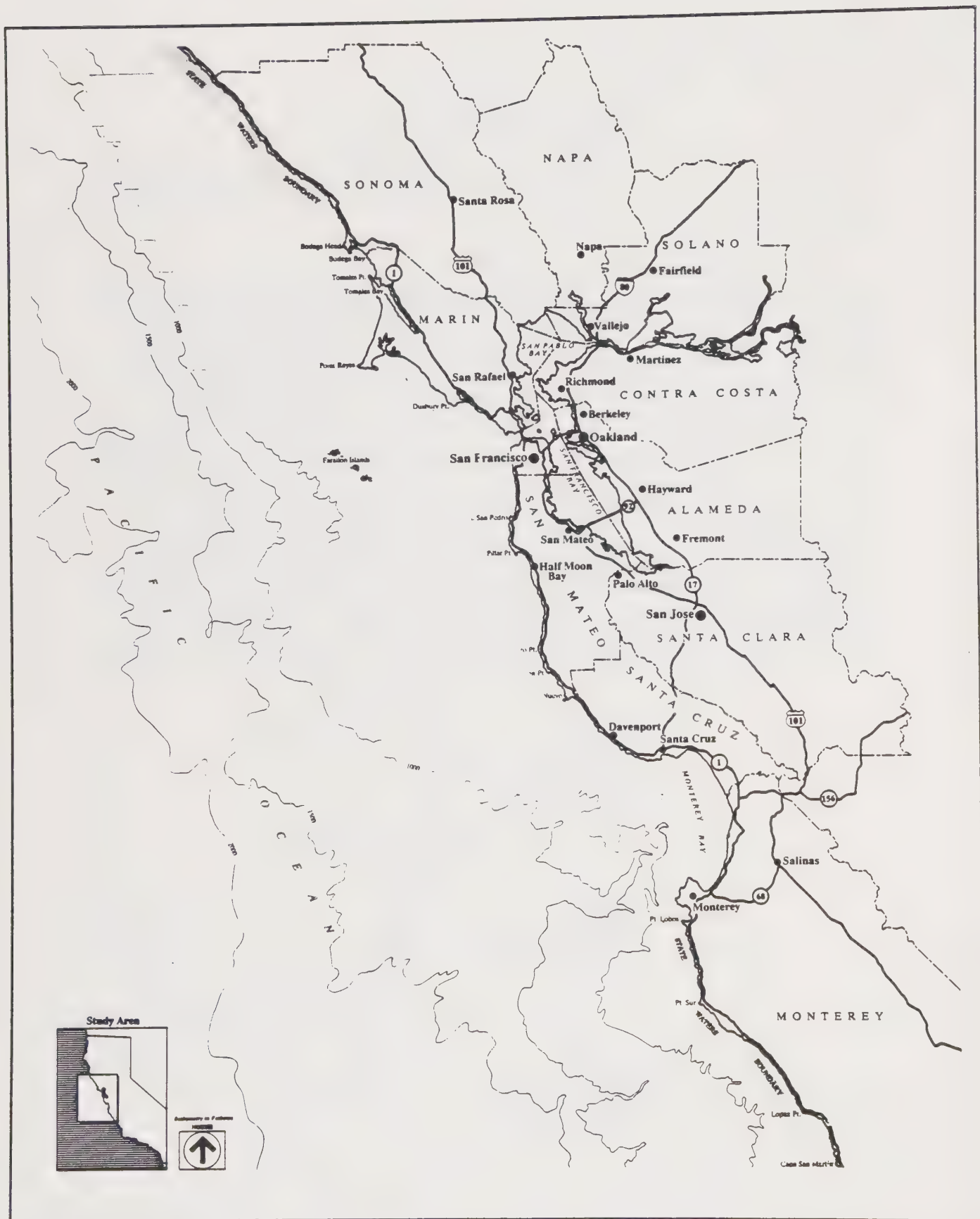
PURPOSE OF THIS REPORT

1.1 INTRODUCTION

The U.S. Department of Interior, Minerals Management Service (MMS) is proceeding with its proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 119 for the central California OCS planning area in March 1991. Lease Sale 119 is part of the MMS's Five-Year OCS Leasing Program, which divides the California coastline into three distinct planning areas: northern, central, and southern California (see Figure 1-1). The proposed Lease Sale 119 area is located off of six central California counties: Sonoma, Marin, San Francisco, San Mateo, Santa Cruz, and Monterey (see Figure 1-2). Lease Sale 91 for northern California (Del Norte, Humboldt, and Mendocino counties) was originally scheduled for October 1989 and Lease Sale 95 for southern California (San Luis Obispo, Santa Barbara, Ventura, Santa Monica, Los Angeles, Orange, and San Diego counties) was originally scheduled for January 1990. However, under the new Bush administration, Lease Sales 91 and 95 have been delayed and it is not certain when these sales will occur.



Figure 1-1. MMS California Planning Areas



1.2 CENTRAL COAST OCS REGIONAL STUDIES PROGRAM

To assist local governments in planning and commenting on the lease sale program, the California State Legislature passed Senate Bill (SB) 959, which provides block grant funds to those coastal and bay area counties to be impacted by the lease sale program. Six central California coastal counties (Sonoma, Marin, San Francisco, San Mateo, Santa Cruz, and Monterey) are cooperatively sponsoring a Central Coast OCS Regional Studies Program to identify and assess the implications of potential offshore oil development related to Lease Sale 119. Each of the six counties has allocated a portion of its block grant to create the Central Coast OCS Regional Studies Program, which is managed by a Board of Control consisting of one Board of Supervisor from each county. Assistance is provided by a Staff Working Group of county planners and a Regional Coordinator, Mr. Warner Chabot of Chabot and Associates, in San Francisco (see Regional Studies Program Participants, page 9-2).

1.3 CENTRAL CALIFORNIA STUDY AREA

The central California study area includes not only the federal OCS lease tracts for Lease Sale 119, but also those onshore areas of the six coastal counties that may be impacted by the development. Specifically, the study area shown in Figure 1-2 includes the following jurisdictions:

- Federal OCS: Federal waters off the central California coast beginning 3 miles from shore;
- State Tidelands: State waters, out to 3 miles seaward, off the central California coast; and
- Onshore Jurisdictions: The six participating counties' coastal zone and inland areas are included in the study area. In addition, existing facilities within Contra Costa, Solano, and Alameda counties are shown on the study area maps because these counties and facilities may be the refining destination of central coast OCS oil and gas.

1.4 PURPOSE OF THIS REPORT

One of the objectives of the Central Coast OCS Regional Studies Program is to conduct a scenario development and environmental analysis of potential offshore development activities related to OCS Lease Sale 119. ERC Environmental and Energy Services Company, Inc. (ERCE), formerly WESTEC Services, was contracted by the Central Coast OCS Regional Studies Program to prepare this element of their program. This study, titled *Offshore Oil Development, Issues and Impacts for the Central California Coast*, was designed to meet the following objectives:

- Provide the public, agency planners, and decision-makers with a clear, concise description of the OCS lease sale process and oil development activities;
- Describe potential scenarios (e.g., volume of oil, number of platforms, onshore facilities, etc.) which would be required to recover oil and gas resources and support OCS development offshore and onshore the central California coast; and
- Identify the key environmental issues and concerns associated with OCS development in the central coast study area.

In this report the reader will find an overview of the OCS lease sale process, a description of offshore oil related activities, and estimates of potential oil and gas resources off central California. The report describes potential development scenarios which could occur if oil development were to take place along the central California coast. Finally, the report discusses the existing environmental and land use conditions along the six counties' coastline and the impacts and issues associated with OCS development.

The scenarios developed in this report are based on the most reliable information available on potential oil and gas resources. However, it is difficult, at best, to accurately predict the future economic and political climate which will directly influence the rate, or even occurrence, of oil development off the central California coast. The scenarios developed in this report should be used for general planning purposes only.

1.5 ORGANIZATION OF THE REPORT

This report is organized into the following chapters:

Chapter 1: Purpose of this Report. This chapter provides background information on the study area and the purpose of this report.

Chapter 2: How the Offshore Oil Permitting Process Works. This chapter provides an overview of the OCS lease sale process and the opportunities for public and local agency involvement.

Chapter 3: A Guide to Offshore Oil and Gas Activities and Related Onshore Facilities. This chapter provides a "generic" description of exploration, development/ production, processing, and transportation activities for offshore oil and gas development.

Chapter 4: Oil and Gas Estimates for Central California OCS. This chapter identifies specific information on offshore geologic structures and estimates of economically recoverable oil and gas reserves in the study area.

Chapter 5: Offshore Oil Development Scenarios for Central California. This chapter describes what is likely to happen if Lease Sale 119 exploration, development, and production activities occur off the central coast.

Chapter 6: Existing Energy and Transportation Facilities in Central California. This chapter identifies existing energy and transportation facilities in the study area which could be used to accommodate offshore oil and gas development activities.

Chapter 7: Environmental Issues and Impacts. A generic discussion of environmental issues and impacts for the key oil activities are overviewed in this chapter.

Chapter 8: County Concerns. This chapter identifies which oil development activities are most likely to impact the central coast counties.

Report Preparers: Lists the project management and staff of the ERCE report team.

Regional Studies Program Participants: Lists the county members of the Central Coast OCS Regional Studies Program.

List of Contacts: Lists the agency and industry contacts made for this report.

References. The references used to prepare this report are listed in this section.

Appendix A: Overview of Offshore Oil and Gas Development

Regulations. This appendix presents an overview of the federal, state and local regulations and agencies which influence offshore oil and gas development. Local control mechanisms, including local oil initiatives, are summarized.

Appendix B: Overview of Coastal Land Use Conditions and Policies for Central California. This appendix provides background information on the coastal land use conditions and policies for the six central California coastal counties participating in this study. Significant coastal resources are briefly discussed along with relevant coastal policies.

Appendix C: Glossary, Abbreviations, and Acronyms. This appendix is a general reference for terms as they are used in this report.



CHAPTER 2

CHAPTER 2

HOW THE OFFSHORE OIL PERMITTING PROCESS WORKS

2.1 BACKGROUND ON THE FEDERAL OFFSHORE LEASING PROGRAM

In 1953 Congress passed the Outer Continental Shelf Lands Act (OCSLA) to expedite exploration and development on the federal outer continental shelf (OCS). The OCS is generally defined as federal submerged lands seaward of a line 3 miles from shore, which is the outer limit of state jurisdiction, out to the 200-mile territorial limit.

In the Pacific OCS region, there have been 11 oil and gas lease sales since OCS oil and gas leasing began in 1963. Nine of the sales have involved tracts off the California coast, most of which occurred off of southern California (see Table 2-1). To date, no commercial discoveries have been made in central or northern California.

Table 2-1
OVERVIEW OF PACIFIC OCS LEASE SALES

<u>Lease Sale No.</u>	<u>Area</u>	<u>Sale Date</u>	<u>Tracts Offered</u>	<u>Tracts Leased</u>	<u>Active Leases^a</u>
P1	California	05/14/63	129	57	0
P2	Washington-Oregon	10/01/64	196	101	0
P3	Southern California	12/15/66	1	1	1
P4	Southern California	02/06/68	110	71	34
35	Southern California	12/11/75	231	56	4
48	Southern California	06/29/79	148	54	13
53	Central California ^b	05/28/81	111	60	43
68	Southern California	06/11/82	140	29	16
RS-2	Central California ^b	08/05/82	27	10	8
73	Central California ^b	11/30/83	137	8	5
80	Southern California	10/17/84	<u>657</u>	<u>23</u>	<u>23</u>
TOTAL			2,083	571	172

a. A lessee usually has 5 years to explore a lease before the lease expires; a lease is active as long as oil or gas is produced.

b. Planning Area at time of sale was called Central and Northern California; all are now within the Southern California Planning Area.

Source: MMS 1987, Pacific Summary/Index.

In 1978 the OCSLA was amended to require preparation of a Five-Year Oil and Gas Leasing Program. The current Five-Year Leasing Program, approved by the federal government in July 1987, consists of a schedule of lease sales for a 5-year period from mid-1987 through mid-1992 and includes policies pertaining to the size, timing, and location of the proposed sales. As a result of this approved Five-Year Leasing Program, 3 of the 5 California lease sales were originally scheduled over the next 2 years, however, under the new Bush administration, Lease Sales 91 and 95 have been delayed. The next potential lease sales are (see Figure 2-1):

- Lease Sale 91 for northern California off Humboldt and Mendocino counties which was originally scheduled for February 1989. Lease Sale 91 has been delayed until sometime after October 1989.
- Lease Sale 119 for central California which is currently scheduled to be held in March 1991.
- Lease Sale 95 which was originally scheduled for January 1990. If it is held it will involve tracts within a 5,000,000-acre area of the OCS extending from Big Sur to San Diego.

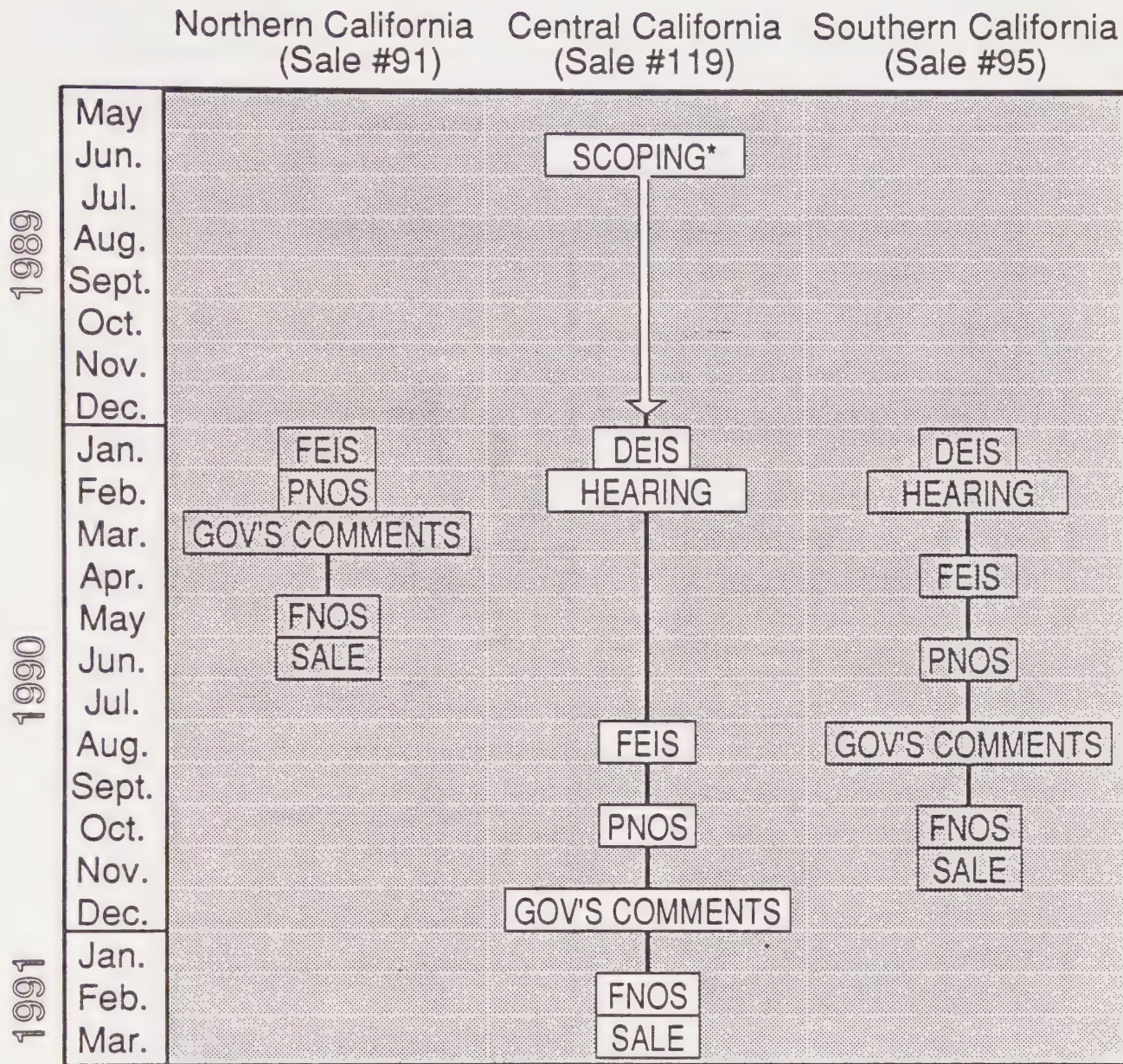
A detailed summary of the lease sale process is described below. A discussion of relevant federal, state, and local offshore oil regulations is found in Appendix A. The OCS leasing process can be divided into two phases or processes. They are the:

- Pre-lease Sale Process
- Post-lease Sale Process

Discussed below are the steps and activities involved in these two processes.

2.2 PRE-LEASE SALE PROCESS

The pre-lease sale process is what precedes the actual sale of offshore tracts by the federal government to the oil industry. This process usually lasts about 2.5 years. The numerous pre-lease sale steps and schedule for Lease Sale 119 are summarized on Figure 2-2 and described below. The opportunities for the public and local government to be involved in the various phases of this process are identified, when applicable.



Note: Schedule current as of 5/2/89. Actual schedule will vary.

*Scoping hearing date to be announced

DEIS: Draft Environmental Impact Statement

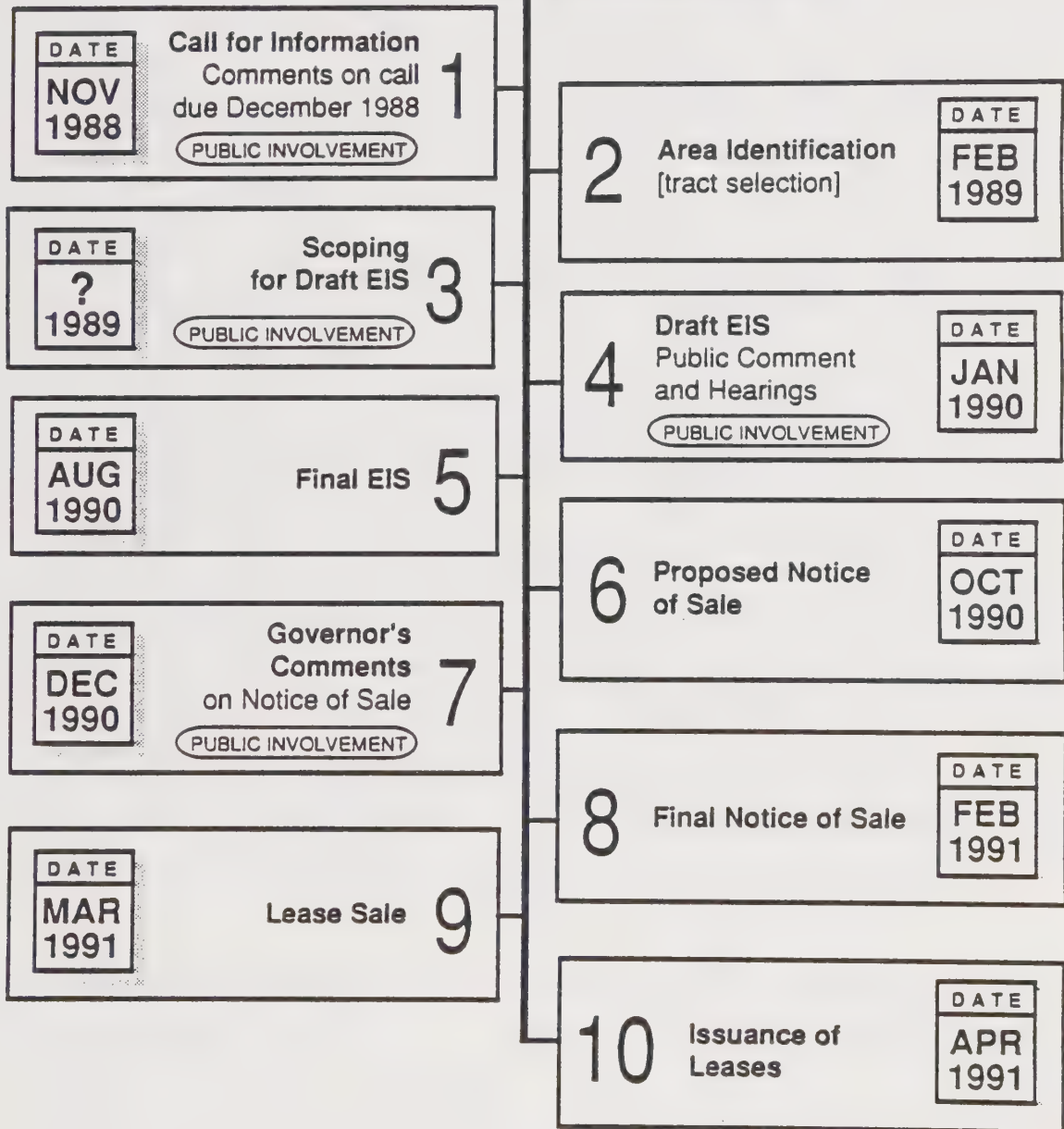
FEIS: Final Environmental Impact Statement

PNOS: Proposed Notice of Sale

FNOS: Final Notice of Sale

CENTRAL CALIFORNIA LEASE SALE 119 PROCESS

AND OPPORTUNITIES
FOR PUBLIC INVOLVEMENT



*Call for Information
and Nominations*

The Call for Information, published in the Federal Register, is the first step in the pre-lease sale process. The Call for Information also informs the public and other agencies of the lease sale area under consideration and identifies regions of hydrocarbon potential. The call is an invitation from the MMS to potential bidders to nominate areas and indicate levels of interest in leasing.

*Notice of Intent
to Prepare an EIS*

A Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) is also published in the Federal Register, announcing the initiation of the EIS scoping process in which issues, mitigations, and alternatives are identified for the proposed lease sale. The notice invites the public and agencies to assist in determining the significant issues and alternatives to be analyzed in the EIS on the lease sale.

*Public/Agency
Involvement*

The Call for Information and Notice of Intent are sent to the governor of each affected state by the Regional MMS Director with a letter inviting comments on the Call for Information. In the letter, the governor is asked to identify issues and areas of concern which should be considered in the development of the initial leasing proposal. The Call for Information and Notice of Intent are the first opportunity for local governments to comment on a proposed lease sale. Local and state agencies concerned with specific areas can submit negative nominations requesting that potential areas be deleted from the lease sale. The Call for Information also solicits comments from agencies and interested parties on any environmental effects and conflicts, as well as coastal zone consistency concerns. States, local governments, and the public have the opportunity to comment on areas or topics of concern. Comments are due 45 days after the call is published. A local government can also present concerns on potential environmental impacts and conflicts to MMS. MMS must respond to the governor's comments; thus, to maximize effectiveness, local governments should forward

their comments to the governor and request that they be incorporated into the state's comments.

Area Identification

About 4 months after the call is published, MMS completes its analysis of nominations and comments. The director of MMS then recommends areas where leasing is expected to occur. Based on comments received, MMS identifies blocks to be further studied for potential leasing and areas to be deleted from consideration where significant resources are threatened or hydrocarbon potential is low. Areas deleted at this stage are called deferred areas.

Following the announcement of Area Identification, MMS provides the governor a response to the state's comments. MMS advises the governor on how comments were employed in the Area Identification process and how they will be used in the development of alternatives and mitigation measures to be analyzed in the EIS. MMS has no statutory responsibility to respond to local governments. Therefore, as mentioned above, it is important to have all local concerns incorporated into the governor's comments.

Scoping Meetings/ Public Involvement

Prior to initiating the EIS, scoping meetings are held by the MMS to define issues and receive comments relating to the proposed lease sale EIS. States, local governments, and the public have the opportunity to provide input at this stage. Local governments may provide comments to MMS on issue areas of concern, proposed alternatives, proposed mitigation measures, and any other local issues of importance that should be analyzed in the EIS. Unfortunately, because a lease sale EIS covers such a large area, specific local government concerns often do not get addressed. However, if a local government wishes to ultimately challenge the MMS document for not addressing such issues, it would be critical to be able to show that they were identified early in the process.

*Draft Environmental
Impact Statement*

About a year after the call is published, a Draft EIS is prepared by the MMS. The Draft EIS describes the potential environmental effects of oil and gas activities in the area proposed for leasing. The Draft EIS also describes the lease sale proposal and the projected exploration and development based on estimated oil and gas resources. An analysis of environmental, socioeconomic, and cumulative impacts is discussed and measures to reduce potential impacts (mitigation measures) are identified. The document also analyzes alternatives to the proposed action. The availability of the Draft EIS is announced in the Federal Register in a Notice of Availability.

*Public Comments
On the Draft EIS*

A 60-day comment period follows public availability of the Draft EIS, during which public hearings are held in the affected regions to provide a forum for public comment. Comments received either at public hearings or in writing are considered in preparation of the Final EIS. Local governments can submit comments to MMS on the adequacy of the document. Comments should focus on potential local impacts which were not identified or were misidentified and should include suggestions for mitigation measures. Unfortunately, MMS must simply respond to comments, not necessarily incorporate them into the final document. As mentioned above, it is still important to comment, especially if a challenge to the document's adequacy is being contemplated.

Final EIS

Three to five months after the public hearings a Final EIS is released which incorporates all comments on the Draft EIS. After the Final EIS, a Secretarial Issue Document (SID) is prepared to analyze all issues involved in the proposed sale. The SID summarizes the conclusions of the Final EIS and considers other issues such as state recommendations and consistency with coastal policies.

Proposed Notice of Sale

The proposed Notice of Sale is issued after the Final EIS is filed. The proposed notice provides information on which blocks are available for leasing, the stipulations for given blocks, the bidding system, and the length of the primary lease term.

Governor's Comments

Section 19 of the OCSLA (43 USC § 1345) was added to ensure opportunities for state and local governments to provide input into Department of Interior's (DOI) decisions about proposed lease sales. This is achieved through consultation and coordination between the DOI and affected coastal states. Pursuant to Section 19, the proposed notice is sent to governors of affected states with a letter requesting comments on size, timing, or location of the sale. A coastal state governor may advise the Secretary of the Interior to delete certain tracts and recommend stipulations to be included in the final lease sale. The governor has 60 days to comment on the proposed Notice of Sale. The secretary must then respond to the governor's recommendation, or implement any alternative identified in consultation with the governor to provide a reasonable balance between the national interest and the well-being of the citizens of the affected state. The secretary can reject a governor's recommendations on the basis of the national interest, and the secretary's decision to reject recommendations may be overturned on judicial review only if found to be "arbitrary and capricious" (43 USC § 1345(d)).

***Agency/Public
Involvement***

Section 19 provides local governments the opportunity to comment on their concerns through their governor. Since Section 19 does not require MMS to accept the governor's recommendations, the consultation process is not always an effective mechanism for states to address their concerns. If the governor's recommendations are not accepted, MMS simply is required to communicate their rationale in writing.

Final Notice of Sale

A final Notice of Sale is issued, if the Secretary of the Interior decides to proceed with the sale, about 90 days after the proposed Notice of Sale is published and after comments on the proposed Notice of Sale are received from the governors. The final notice is published in the Federal Register, not less than 30 days before the sale is conducted, and specifies the blocks to be offered, the stipulations for given blocks, the bidding system, the length of the primary lease term, the date of the lease sale, and other pertinent information.

Lease Sale

Not less than 30 days after the final notice is published, a sale is conducted by the appropriate MMS regional office. Sealed bids submitted by qualified bidders are opened and read at the public sale. High bids are accepted or rejected in a process that ensures fair market value on lease blocks containing potentially viable prospects. The secretary has up to 90 days after receipt of bids to either accept or reject a bid. Normally, bids are accepted and leases issued within 1 to 2 months after the sale.

Issuance of Leases

Once awarded, a lease grants the right to explore, develop, and produce oil and gas for a specific term on a specific tract (usually 5760 acres). The lessee has 5 to 10 years to begin exploratory drilling, before losing the lease, depending on the lease term. The lease is extended for as long as oil and gas are commercially produced. Lease rentals and royalties must be paid to the federal government.

2.3 POST-LEASE SALE PROCESS

The post-lease sale processes are those oil activities that occur after the lease sale and typically consist of three steps or phases. They are the:

- Exploration Phase;
- Offshore Development and Production Phase; and
- Onshore Development Phase.

These phases are summarized in Table 2-2 and described in more detail below. The opportunity for local government involvement is highlighted.

Exploration

Plan of Exploration

Exploratory activities are undertaken by oil companies to ascertain the presence and extent of commercially recoverable oil and gas reserves. Under the Department of Interior's "due diligence requirement" a company usually explores a lease and files a Plan of Exploration (POE) before the end of the fourth lease year for a 5 year lease or the lease expires (the due diligence requirement is specified in the lease). Oil and gas activities on a lease begin with the lessee's acquisition of the information necessary to compile a comprehensive plan of exploration. Before exploratory drilling can begin on a leased tract, a POE and environmental report (ER) must be submitted for review and approval by the MMS. The entire exploration phase usually lasts 3 to 5 years, depending how quickly a company pursues its permits.

The POE is prepared by the oil company and describes the proposed drilling site or sites and the planned exploratory operations. Federal regulations (30 CFR 250.34-1) require the POE to describe: the proposed type and sequence of exploration activities and a timetable for their execution; the proposed exploratory rig; the geophysical equipment to be used; the location of each proposed well; and the structure and formations expected to be drilled. The ER supplements the information in the POE and helps in the assessment of impacts. Additional information may be required by the Pacific OCS regional office. In addition, an oil spill contingency plan, critical operations and curtailment plan,

Table 2-2

SUMMARY OF THE STEPS IN OCS
POST-LEASE SALE PROCESS

	<u>Local Government Participation</u>
Exploration Phase:	
1. Plan of Exploration	√
2. Approval or Disapproval	
3. Consistency Certification	√
4. Environmental Assessment	√
5. MMS Application for Permit to Drill	
6. Other Federal Permits	√
7. Exploratory Drilling Begins	
Offshore and Onshore Development Phase:	
1. Development and Production Plan (DPP)	√
2. Onshore Development Planning	√
3. Consistency Certification by Coastal Commission	√
4. Consultation with Local Governments ^a	√
5. Determination to Prepare an EIR/S	
6. EIR/S Scoping Process	√
7. Draft EIR/S, Public Comment and Hearing on Draft EIR/S	√
8. Final EIR/S	
9. DPP Approval or Disapproval	
10. Final Development Plan/Local Agency Permits	√
11. MMS Application for Permit to Drill	
12. Building, Grading, and Construction Permits	√
13. Air Quality Permits	√
14. Other Federal Permits	√
15. State Permits ^b	√
16. Offshore Development Begins	

a. Indicates local government involvement through the governor.

b. State permits could come before local permits, depending on which agency is the lead agency.

and hydrogen sulfide contingency plan, must be submitted. MMS has 10 working days to either deem the application complete or return it to the lessee if more information is required. Once an application is complete, it is deemed "submitted" by MMS.

In California, the POE and ER must be accompanied by a certificate of consistency if the proposed exploration activities will affect any land or water use in the coastal zone (see step 3 below). The POE, ER, and certification must be submitted to the California Coastal Commission for consistency review.

Exploration

Public/Agency Involvement

Copies of the complete POE are distributed to affected states, federal agencies, and the public for review. Local governments have the opportunity to comment to MMS on the plan, however MMS is under no obligation to consider the comments they receive. MMS forwards the POE to the Environmental Protection Agency (EPA), the U.S. Department of Army Corps of Engineers (COE), the California Coastal Commission (CCC), and the governor for review and comment. The CCC sends copies of the POE to state and local agencies and all comments are due to MMS within 20 days of the MMS date of POE submittal.

Exploration

Approval or Disapproval

Within 30 days after the POE has been deemed complete, the MMS must approve it, require modification of it, or disapprove it. The plan is approved if it conforms to the provisions of the lease and the OCS Lands Act. However, no license or permit required for exploration activities may be issued until the CCC's consistency concurrence is received.

Exploration

Consistency

Certification

Section 307 (c)(3) of the Coastal Zone Management Act (CZMA) requires that an applicant submitting an OCS exploration or development and production plan for an activity affecting "land and water uses" in the coastal zone, certify to the state that the proposed activity will be consistent with California's coastal management program.

The time clock for state review begins on the date the POE, consistency certificate, and other supporting information are received. The state has 3 months to concur or object to the proposed activity or must request a 3-month extension. Concurrence is presumed after 6 months. The consistency process provides local governments the opportunity to comment on exploration and development and production activities.

The CCC's consistency process involves analysis of the project to determine if it is consistent with California's Coastal Management Program. All of the six participating counties have approved local coastal programs (LCPs) which have been incorporated into the state's federally approved program and are considered in the consistency review. However, because exploration activities do not usually involve any permanent onshore support facilities, the LCPs do not have much relevance at this stage. Nevertheless, a local government has the opportunity to comment in writing and attend the CCC consistency hearing.

If the CCC objects to the POE's certificate of consistency, the applicant may appeal the objection to the U.S. Secretary of Commerce. The CCC must forward findings to the secretary on why the POE is not consistent with the state's coastal management program. The Secretary of Commerce may hold a public hearing and may override the CCC's

objection on the grounds of national security or a finding that the POE is consistent with the CZMA.

Exploration

Environmental Analysis

The POE is required to undergo technical analysis by MMS and requires environmental review under the National Environmental Policy Act (NEPA). An environmental assessment (EA) is prepared to evaluate the likely impacts and to determine if the proposed project would be a major federal action significantly affecting the human environment, thus requiring an environmental impact statement (EIS). If it is determined that an EIS is required, the scoping process is initiated. If the EA concludes an EIS is not required, a finding of no significant impact (FONSI) is prepared by MMS briefly stating the reasons why the action will not have a significant impact on the environment.

Environmental review of exploration plans by the MMS tend to result in a FONSI as documented by an environmental assessment. In such a case, an EIS is not required. MMS must give public notice of the availability of EAs and FONSI. Under limited circumstances, where the proposed action is similar to one which normally requires an EIS, MMS is required to make the FONSI available for public review for 30 days before the agency makes its final determination whether to prepare an EIS. A FONSI generally takes up to 3 months to finalize.

Exploration

Application for Permit to Drill

Once an exploration plan is approved and the state concurs with the lessee's consistency certification, a lessee must submit and receive approval of an application for permit to drill (APD) from MMS before beginning exploratory drilling operations. The permit to drill must conform to the applicable approved POE; therefore, it is not subject to separate consistency review under CZMA.

Exploration

Other Federal Permits

Several other federal permits are required before a lessee can begin drilling, including a National Pollutant Discharge Elimination System (NPDES) permit and an Army Corps of Engineers (COE) Section 10 permit. Pursuant to Section 402 of the Clean Water Act, the lessee must apply to EPA at least 180 days before discharge for authorization to discharge under the NPDES . EPA invites comments from states and other interested parties in a public notice of its proposed issuance, denial or modification of the NPDES permit.

California has included NPDES permits in its federally approved Coastal Zone Management (CZM) program; therefore, the lessee must also submit a consistency certificate to EPA. The CCC has the opportunity to concur or object to the consistency certificate. Local governments have the opportunity to participate in the California Coastal Commission's consistency process, and if they find the proposed activity inconsistent with the state's coastal management program or their LCP, they can ask the commission to object to the issuance of the permit.

Under Section 10 of the River and Harbor Act (33 U.S.C. § 403), a lessee must apply to the COE for a permit to construct, install, maintain, and operate structures required for exploration operations. Like the NPDES permits, California's coastal management program includes COE permits in their program and, therefore, the CCC is given the opportunity to concur or object to the consistency certificate. Local governments have the opportunity to participate in this process also.

Exploration

Exploration Drilling

Once all permits are obtained, the lessee will begin exploration drilling. All the information acquired from the test wells is analyzed and a decision is made as to whether further drilling is warranted.

Development

Development and

Production Plan (DPP)

After completing the exploration drilling, the oil company will decide whether to develop the lease and locate a platform on it. If the lessee decides to proceed with development, they must submit a Development and Production Plan (DPP) to the MMS. This plan is similar to an exploration plan and is subjected to an analogous review process. Federal regulations (30 CFR 250.34-2) require the DPP to describe: all the work to be performed to achieve sustained production; all drilling vessels, platforms, pipelines, or other facilities and operations; surface and bottom-hole locations of each proposed well; interpretations of all relevant geological and geophysical data; environmental safeguards to be implemented; safety standards and features; the expected rate of development and production; and other relevant information the MMS may require.

If an OCS development project requires onshore facilities (pipelines, processing facilities) the oil company will be required to prepare a separate development plan application to the state and local jurisdictions for their proposed facilities (see Onshore Development Planning below). In addition, an oil spill contingency plan, critical operations and curtailment plan, hydrogen sulfide contingency plan, ER, and certification of consistency are also required. A DPP and related plans can take up to 6 months to prepare. After the DPP has been deemed complete, the MMS forwards the DPP to relevant federal, state, and local agencies, the Governor of California and the CCC for review and comment. This is a 60 day review period. In addition, the

CCC initiates their consistency review process. After receiving all comments, conducting an environmental review, and after the CCC makes its consistency determination, MMS approves or disapproves the DPP.

Development

Consistency Certification

The DPP and consistency certification must be submitted to the CCC for consistency review. The CCC has up to 6 months to determine if the activities described in the plan are consistent with its program. The consistency process, as described earlier, may occur before completion of the environmental impact report/statement (EIR/S); however, the CCC has raised objections to voting on consistency before the Final EIR/S is approved. Therefore, this step in the process has resulted in negative decisions or delays until the EIR/S is reviewed.

Development

Consultation with Local Governments

Section 19 of the OCS Lands Act provides for the Governor of California and the executive of any affected local government to be given 60 days to make recommendations regarding the DPP. Recommendations offered during this consultation process are accepted if they are determined to provide for a reasonable balance between the national interest and the well-being of the citizens of the affected states. If MMS rejects the state's recommendations, the Director of MMS must write to the governor explaining why the state's recommendations were rejected. It is most effective for a local government to get their concerns and comments on a DPP incorporated into their governor's comments because MMS is not required to respond to local governments' recommendations.

Development

Onshore Development Planning

The local/state permit process for onshore facilities is initiated when a formal development plan application is submitted. An application package for proposed onshore oil facilities can include a development plan, general plan or LCP amendment, rezone, conditional use permit, coastal development permit, land use permit, and/or an authority to construct permit. Table 2-3 describes each type of local permit required by Santa Barbara County as an example of a local permitting process. The six counties in the study area have not developed specific permit procedures for offshore-related oil and gas development.

Per state planning law, a local agency has 30 days in which to deem an application complete or incomplete. The application review/response process can take 4 to 5 months before an application is deemed complete. Once an application is deemed complete, the type of environmental review necessary to fully evaluate the impacts associated with a project is determined.

Development

Determination to Prepare an EIR/S

The DPP undergoes NEPA review (30 CFR 250.34-4), which is similar to the review conducted for an exploration plan. An EA is prepared to evaluate the likely impacts and to determine if the proposed project would be a major federal action significantly affecting the human environment thereby requiring an EIS. An EIS is almost always required for an OCS DPP. If it is clear that an EIS will be required, MMS may chose to bypass the EA and begin the EIS process immediately.

Development

EIR/S Scoping Process

For a DPP that proposes both offshore and onshore oil facilities, an EIR/S which fulfills both NEPA and the California Environmental Quality Act (CEQA) is usually

Table 2-3

**TYPES OF LOCAL GOVERNMENT PERMITS REQUIRED
FOR ONSHORE OIL-RELATED DEVELOPMENT**

<u>Permit</u>	<u>Description</u>	<u>Example of Activity</u>
Development Plan	Required for larger projects which require comprehensive review due to type, scale, or location. A preliminary and final development plan (PDP and FDP) are required.	Oil and gas processing facilities, pipeline corridors
General Plan/Local Coastal Program (GP/LCP) Amendment	Required to change a land use designation of a property identified in the comprehensive/coastal plan.	Installation of tank farm on land classified as open space
Rezone	Required for projects proposed on property where the project is not a permitted use in the zone district. Often filed with a GP/LCP Amendment	Oil and gas processing facility in area zoned agricultural
Conditional Use Permit (CUP)	Conditional uses are identified in county ordinances. Either a major or minor CUP is required for uses that are not normally permitted within a particular zone district.	Pipeline through environmentally sensitive habitat
Coastal Development Permit/ Land Use Permit	Ministerial ^a permits are issued after all other permits have been obtained. Once obtained, permittee may begin actions to obtain building, grading, and construction permits.	Pipelines through environmentally sensitive habitat
Authority to Construct (ATC)	Required by the County Air Pollution Control District prior to activities with emissions that exceed set thresholds.	Oil and gas processing facilities, marine terminals, tank farms, pipeline pump stations

a. Ministerial describes a governmental decision which involves little or no personal judgement. The public official merely applies the law to the facts as presented. Ministerial permits are usually approved by the local government staff rather than the Planning Commission.

prepared in conjunction with the state and affected local jurisdictions. The platform is usually only one element in a broader development plan which includes pipelines across state tidelands and extensive onshore development in a local jurisdiction. Instead of each jurisdiction requiring a separate environmental report for discrete elements of the same overall project, a single report addressing the issues of importance to all the agencies is often prepared under the management of a "Joint Review Panel" (JRP)¹. The membership of the JRP is made up of representatives of all the jurisdictions having permit or other authority, over the development. The JRP has the responsibility to oversee the preparation of the EIR/S, coordinate the various agencies' review of the document's draft products, and to hold the public hearings.

Before a JRP begins its environmental review, they will conduct a scoping hearing to hear what issues the public wants emphasized in the impact report. As described earlier, after the scoping hearings, the issues to be analyzed in the document are determined. If a proposed project has onshore components, the joint environmental analysis is the ideal opportunity for local governments to work with federal and state agencies in order to assure that issues of local importance are adequately analyzed. The importance of being lead agency under CEQA is a critical issue of which local governments need to be aware. In the past, if significant onshore impacts are anticipated for federal projects, the state and federal agencies usually allow the local government to be lead agency. The lead agency manages the consultant who prepares the EIR/S, certifies the EIR/S, and is the first agency to act on the project.

¹One of the agencies on the JRP has the responsibility to administer the contract with the consultant preparing the EIR/S. The document is called an EIR/S because the state and local governments under the CEQA, call the document a "Report" while the MMS, under the NEPA call it a "Statement," hence EIR/S.

Development

*Draft EIR/S,
Public Comments,
and Hearing on
the Draft EIR/S*

A Draft EIR/S for a major oil project can take up to 9 months to prepare. A 60-day public comment period follows the public availability of the Draft EIR/S. Comment can be submitted at either a public hearing or in writing. Local governments should focus their comments on potential significant impacts and should include suggestions for mitigation measures.

Development

Final EIR/S

All comments from the public period, and any Draft EIR/S revisions are incorporated into a Final EIR/S.

Development

*DPP Approval
or Disapproval*

MMS must approve, modify, or disapprove the DPP for the OCS facility within 60 days after the release of the Final EIR/S. The MMS cannot approve the DPP until the CCC has concurred with the applicant consistency certification. Also, the MMS does not have review or approval authority over the onshore oil facilities proposed in the local agency development plan applications.

Development

*Final Development
Plan/Local Agency
Permits*

After the EIR/S is certified, each agency (federal, state, and local) will develop permit conditions on the project. At the local county level the county planners will prepare a staff report on the project, which makes recommendations for approval or disapproval, and supporting documentation. County staff presents the staff report to the Planning Commission at a public hearing. The Planning Commission has final action on development plans that comply with existing zoning, a conditional use permit, or a variance. Their decision may be appealed to the Board of Supervisors. Rezoning, comprehensive plan/LCP amendments, and specific plans require final approval by the board. If the permit package is approved by the county, the applicant must

comply with all conditions of approval before they receive their Final Development Plan (FDP) and Coastal Development Permit/Land Use Permit (CDP/LUP). A CDP/LUP is a ministerial permit issued after all other permits have been obtained (see Table 2-3).

Development

Application for Permit to Drill

An application for a permit to drill (APD) is filed with the district MMS/OCS office by the lessee or operator. A lessee may not drill any well until he receives approval of an application for permit to drill. The permit to drill must conform to the applicable approved DPP; therefore, it is not subject to separate state consistency review under CZMA.

Development

Building, Grading, and Construction Permits

Once a FDP is approved by the local agency and a CDP/LUP is issued, the permittee may begin actions to obtain building, grading, and construction permits.

Development

Air Quality Permits

Local governments control air quality out to 3 miles offshore through local air pollution control districts (APCDs). Three APCDs cover the six central coast counties. The Bay Area Air Quality Management District includes Marin, San Francisco, San Mateo, and southern Sonoma counties. Northern Sonoma County Air Pollution Control District (APCD) covers Northern Sonoma County and the Monterey Bay Air Quality Management District covers Monterey and Santa Cruz counties . All three districts are nonattainment areas for ozone. See Section 7.1 for more detail on air quality impacts.

Any person or organization proposing to construct, modify, or operate a facility or equipment that may emit pollutants from a stationary source into the atmosphere must first obtain an Authority to Construct (ATC) from the county or

regional APCD. APCDs issue permits and monitor new and modified sources of air pollution to ensure conformance with national, state, and local standards for air quality and to ensure that emissions from such sources will not interfere with the attainment and maintenance of air quality standards. Each APCD uses its own application form for the ATC permit.

Development

Other Federal Permits

Like exploration, offshore and onshore development and production activities require wastewater discharge permits (NPDES) and COE Section 10 permits, with associated consistency review. In addition, U.S. Fish and Wildlife requires a Section 7 (Rare and Endangered Species) consultation. A list of all agency permits is found in Table 2-4. Please refer to Appendix A for an overview of offshore oil and gas development regulations.

Development

State Permits

Development projects which include subsea pipelines to shore, a marine terminal, or other onshore facilities in the coastal zone require specific permits from state and local agencies. For pipelines which cross state waters, a pipeline right-of-way land use lease is required from the California State Lands Commission (SLC). Any development within the coastal zone also requires a coastal development permit (CDP) from the CCC. This includes energy facilities such as marine terminals, piers, pipelines, and oil platforms in state waters. The local government regulates the portion of a facility located within its permit jurisdiction. The six central coast counties would issue a CDP by authority of their approved LCPs for onshore development in the coastal zone. Therefore, two CDPs (one from the CCC and one from the local government) are required for facilities which cross both state and local jurisdictions. The onshore permitting process

Table 2-4

MAJOR AGENCIES, LAWS AND PERMITS AFFECTING OFFSHORE OIL DEVELOPMENT

Agency	Law	Permit
Federal:		
Minerals Management Service	Outer Continental Shelf Lands Act Amendments (OCSLAA) 43 U.S.C. § 1331-1356	Permit to Drill
National Oceanic and Atmospheric Administration (NOAA)	Coastal Zone Management Act (CZMA) 16 U.S.C. § 1451-1464	Consistency Certification ^a
Environmental Protection Agency (EPA)	Clean Water Act 33 U.S.C. § 1251-1376	NPDES
Army Corps of Engineers (COE)	River and Harbor Act of 1899 33 U.S.C. § 401 et seq.	404 Permit, Section 10 Permit
U.S. Fish and Wildlife Service, National Marine Fisheries Service	Endangered Species Act 16 U.S.C. § 1531-1543	Section 7 Consultation
Applies to all Agencies	National Environmental Policy Act 42 U.S.C. 4371 et seq.	Environmental Impact Statement
State:		
California State Lands Commission	Submerged Lands Act 43 U.S.C. § 1301-1315	Right-Of-Way/Land Use Lease
California Regional Water Quality Control Board	Porter-Cologene Act Water Code, § 13000 et seq.	NPDES
California Department of Fish and Game	California Fish and Game Code § 1600-1607	Stream Alteration Permit
Department of Transportation (Caltrans)	Streets and Highway Code § 660-734	Encroachment Permit
Applies to all Agencies	California Environmental Quality Act (CEQA) PRC § 2100 et seq.	Environmental review process
California Coastal Commission (CCC) ^b	California Coastal Act PRC § 30000 et seq.	Coastal Development Permit
Air Resources Board	California Air Pollution Control Laws	

Table 2-4 (Continued)

MAJOR AGENCIES, LAWS AND PERMITS AFFECTING
OFFSHORE OIL DEVELOPMENT

Agency	Law	Permit
Local: County/City governments (Planning Departments)	General Plans Zoning Ordinances Local Coastal Plans	Land Use Permit/Coastal Development Permit, Conditional Use Permit
Air Pollution Control Districts	Local rules and regulations	Authority to Construct, Permit to Operate (PTO)

- a. The office of Ocean and Coastal Resource Management (OCRM) within NOAA administers the CZMA for the Secretary of Commerce and publishes regulations which implement the act.
- b. The CCC reviews federal permits for consistency with the federally approved California Coastal Management Program.

can take several years and require substantial input from county staff. The local planning process is discussed in more detail in Appendix A of this report.

Development

Offshore Development Begins

After the Permit to Drill is approved by the MMS and all other permits are acquired, platform construction begins. Once the platform is in place, development wells are drilled and production begins, assuming all onshore support facilities have been permitted and built.



CHAPTER 3

CHAPTER 3

A GUIDE TO OFFSHORE OIL AND GAS ACTIVITIES AND RELATED ONSHORE FACILITIES

This chapter is a "primer" on offshore oil and gas activities. It is designed to serve as an introduction to offshore oil terminology and technologies. The chapter begins with exploration and proceeds through development, platform production, and transportation activities. It also describes the many support activities that often are found with offshore development projects. This chapter simply defines the activities but does not identify what could occur offshore central California if Lease Sale 119 were to proceed. Scenarios for offshore development are discussed in Chapter 5.

3.1 EXPLORATION ACTIVITIES

Prior to a lease sale, exploration for offshore oil and gas involves geophysical surveys to evaluate underlying geological formations. Exploratory drilling by a developer occurs after a bidder successfully leases a tract. Should oil and/or gas be discovered in quantities that are economically recoverable, the development phase is initiated. This consists of establishing offshore oil platforms and drilling of development wells to recover the oil/gas. Discussed below are the exploration activities undertaken to evaluate whether commercial quantities of oil and/or gas are present within a specified area.

Geophysical Surveying

Geophysical surveying is usually conducted prior to a lease sale to determine seismic properties of underlying geologic formations. The prime objective of a geophysical survey is to identify and locate favorable reservoir rocks and structures where oil and gas may have accumulated. The most common geophysical survey technique is seismic analysis which uses blasts from underwater air guns and detection of refractions from these sound blasts off geologic strata. Digital processing of the complex acoustical responses provides information on the hydrocarbon-bearing characteristics of underlying geologic formations.

The air gun consists of a chamber filled with compressed air which is suddenly released. Air is pumped back into the guns and released again, resulting in another blast. Blasts occur at about 10 second intervals. Four to 12 air guns are usually towed behind the

survey boat at a depth of about 30 feet with hoses extending from them to air compressors on deck (see Figure 3-1). Lines of air guns are up to 2 to 3 miles long.

Seismic surveys are made by oil companies themselves or through contracts with companies specializing in this type of work. In 1983, about 74 percent of the crew months for west coast marine petroleum seismic activity was contract work (MMS 1985a).

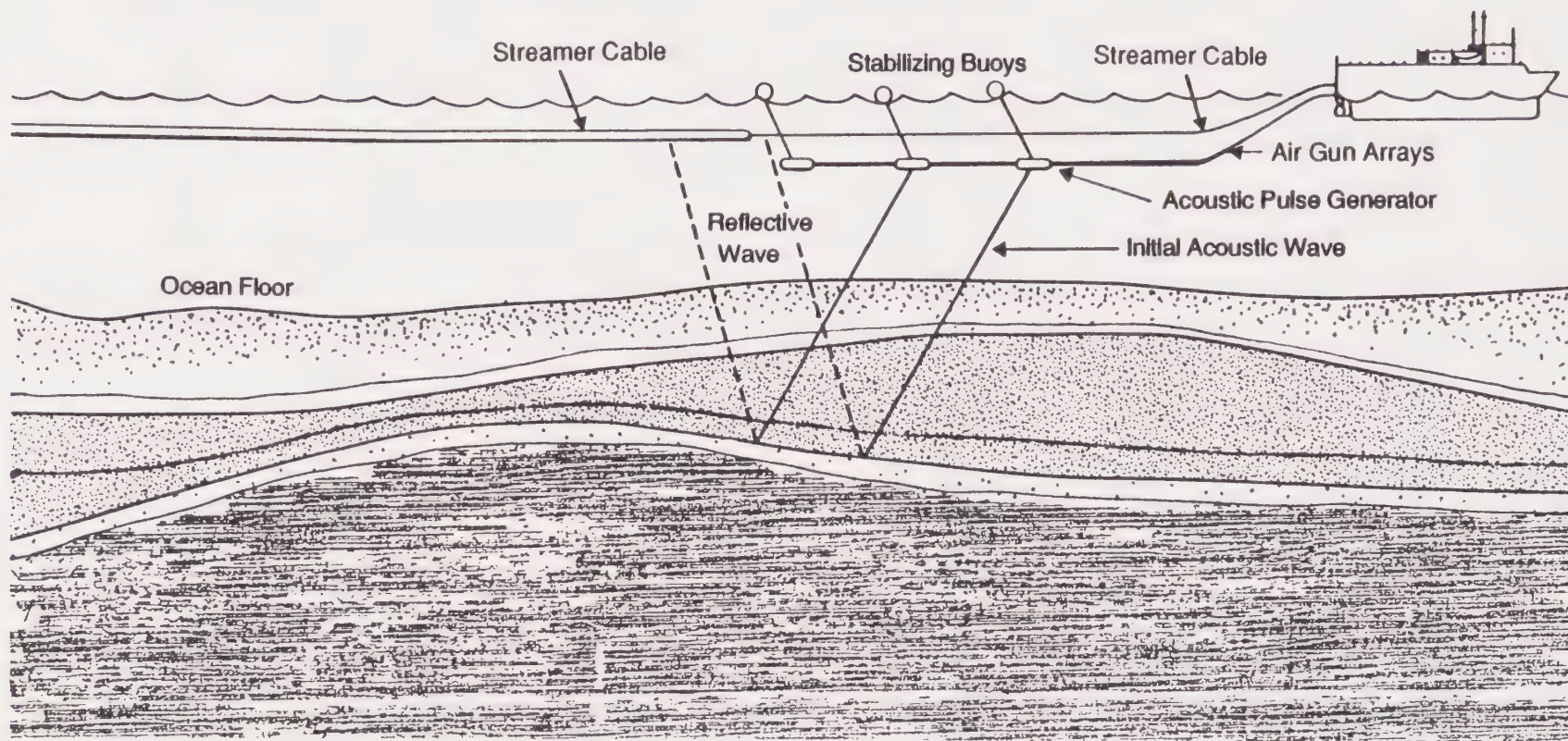
Seismic surveying requires a permit from the Mineral Management Service (MMS).

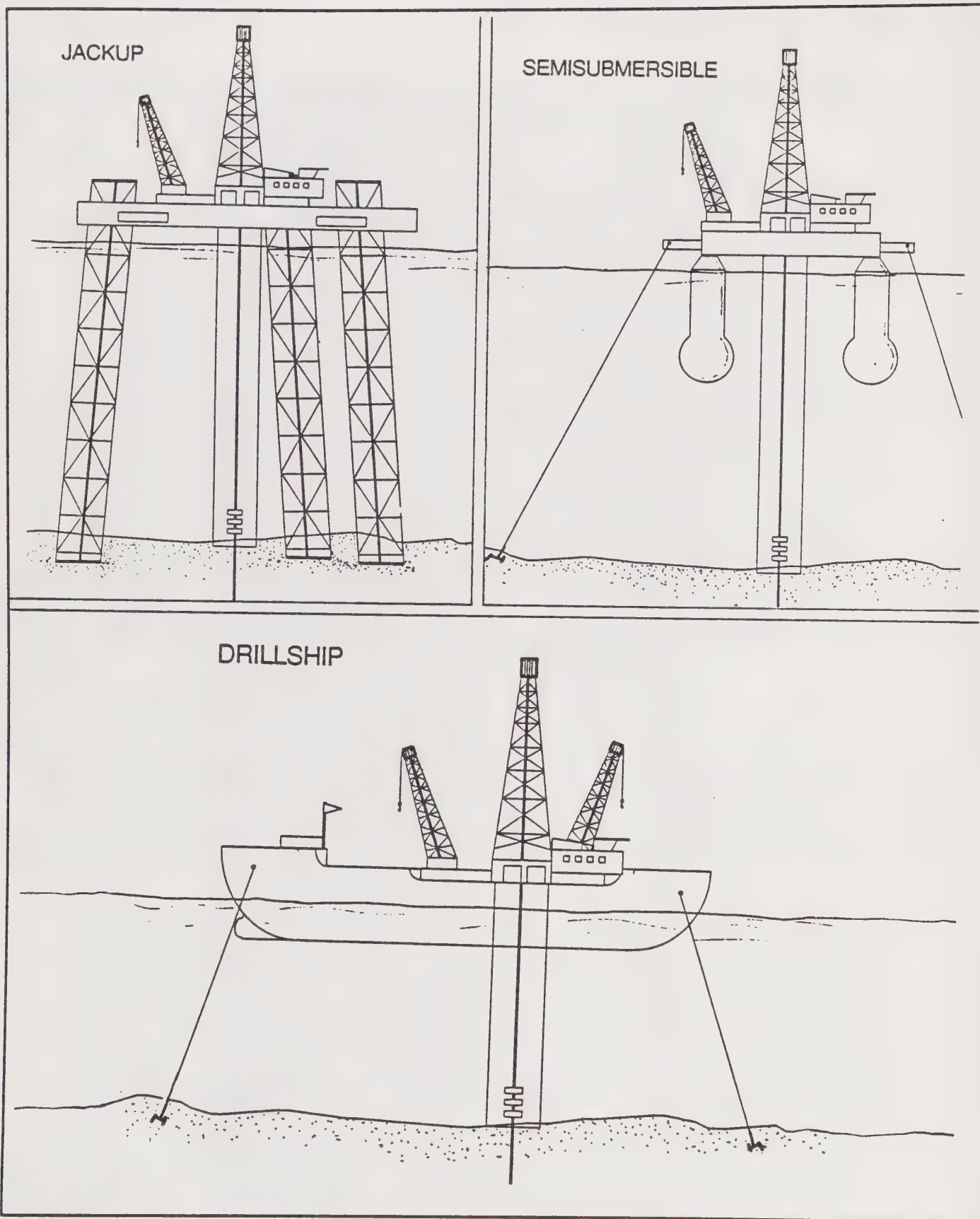
Typically, a geophysical surveying company will apply to MMS for a geological and geophysical ("G & G") permit. After a permit application is filed with MMS, federal and state agencies, the commercial fishing community, harbor masters, and other interested parties are notified of the permit application. After a 14 day comment period, MMS can issue a permit. The entire process usually takes approximately 30 days (personal communication, Randal Ashley, April 1989). Between 1963 and 1983, 538 permits were issued for geological and geophysical exploration on the Pacific OCS (MMS 1985a). As a condition on the permits, MMS is able to acquire some of the survey data for use in lease sale reports. Seismic surveying vessels are able to remain offshore for long periods of time, returning to port for crew changes and provisions approximately every 3 weeks. A seismic crew can survey approximately 1,200 to 1,800 miles per month (MMS 1985a).

Exploratory Drilling

Exploratory drilling, the second phase of exploration, occurs after a bidder successfully leases a tract and obtains all necessary permits. In this phase, drilling is restricted to searching for commercial quantities of oil and gas. The approval process for exploratory activities is discussed in Chapter 2.

The equipment used in exploration drilling is called the drilling rig. The three major types of rigs used in offshore exploration are: 1) jack-up rigs, 2) semi-submersible drilling rigs, and 3) drillships (see Figure 3-2). It is not possible to predict precisely which type of exploratory drilling rig will be used in each OCS leasing area, but the selection will depend primarily on availability of equipment and characteristics of the drilling location. Drillships have good mobility and are the only drilling rigs which currently can operate in waters over 1500 feet in depth. They are, however, easily affected by poor weather and high wave action. Jack-up rigs have only fair mobility, but excellent stability. They are generally restricted to a maximum water depth of 375 feet. Semi-submersibles lie between jack-up





rigs and drill ships in mobility, stability, and maximum water depth capability, usually operating in depths of 300 to 1500 feet .

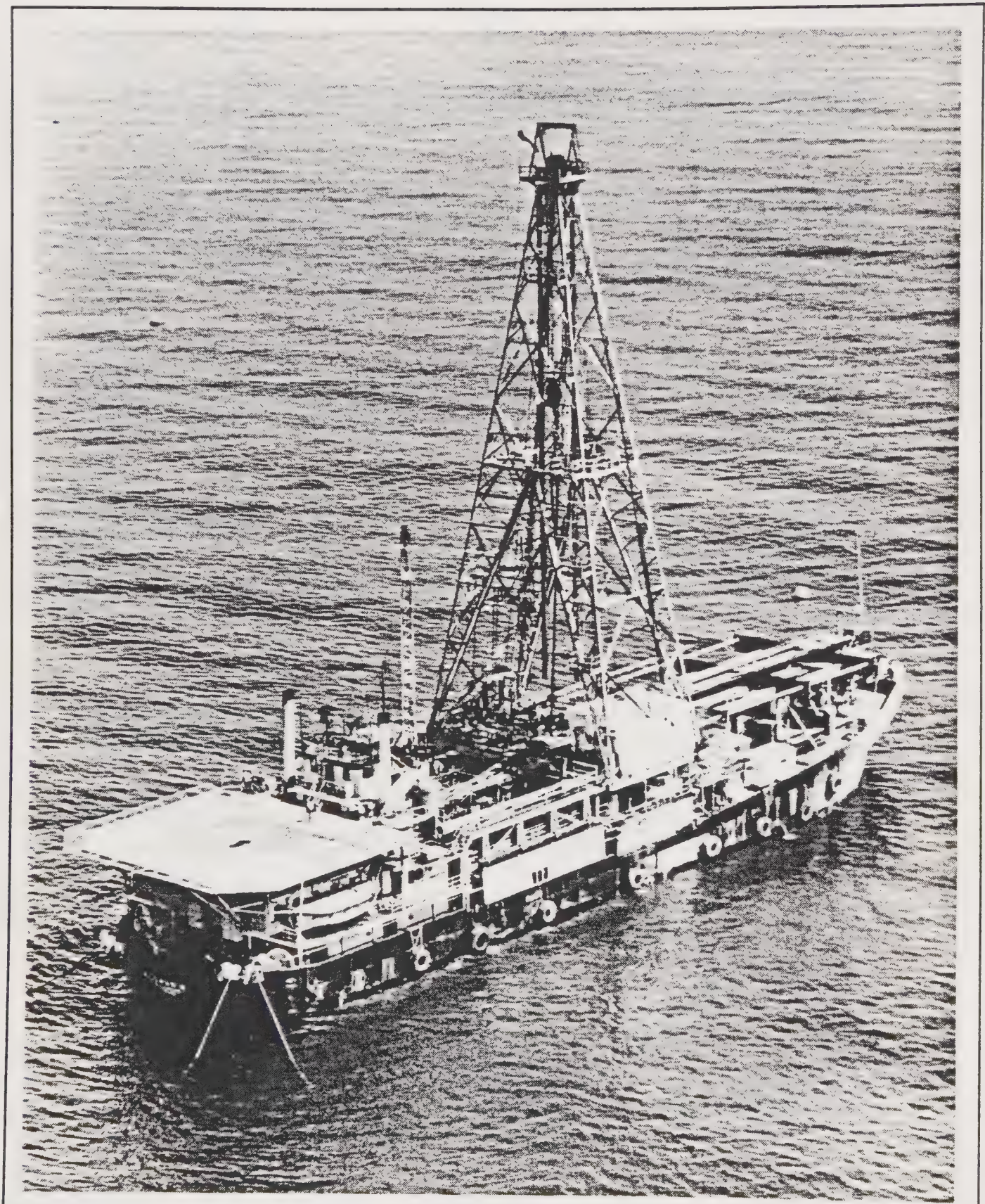
The jack-up rig is essentially a floating, barge-like hull which supports a rig. When it reaches the drill site (usually towed by tugs), legs "jack up" the rig from the sea bottom and it becomes a drilling platform. Jack-up rigs are built and serviced at existing ship yards and other coastal steel fabrication facilities.

The most recent development in floating platforms is the semi-submersible drilling rig. The major buoyant support consists of pontoons which ride on the surface when the rig is being towed and which are sunk well below the waterline when it is drilling. The rig is anchored in place during drilling.

A drillship is self-propelled which allows for greater mobility and dynamic positioning. It is moored to anchors during drilling operations. Drilling is conducted from the deck of the ship, while various internal compartments provide crew quarters and storage space (see Figure 3-3).

Usually drilling rigs are relatively self-sufficient, the amount of supplies obtained from shore depends on such factors as water depth, well depth, drilling rate, formation type, and weather. Active drilling constitutes approximately two-thirds of the drilling period while evaluation, abandonment, and travel make up the balance of the time. Typically, exploratory drilling takes from 60 to 90 days. Each exploratory rig can drill approximately six wells a year. A typical exploration program drills on the average of four wells per lease.

Rotary well drilling equipment is generally used for all exploratory wells. A length of large-diameter steel casing is installed from the drilling unit into the borehole and cemented in place to form a secure base for further drilling. A smaller-diameter surface casing is installed inside this conductor casing. A high pressure blowout prevention (BOP) system is then installed on top of this casing and tested to ensure well flow control. Once the casings and BOP are in place, drilling continues.



Testing and Abandonment

Each exploratory well is tested for the presence of hydrocarbons. At the completion of testing, each exploration well is abandoned or suspended in accordance with regulatory stipulations to prevent any oil/gas from seeping into the ocean.

Transportation of Supplies and Wastes

Exploratory rigs stay onsite throughout drilling and require supply and transportation services from onshore. The primary supplies (in terms of bulk) transported from shore during exploration are water (both potable and drilling water), mud, cement, diesel, and tubular goods. Muds and cuttings which are not contaminated are usually disposed of offshore, while general refuse and contaminated muds and cuttings are transported back to shore for disposal. All these materials are generally transported by supply boats that typically make about two roundtrips per week to an exploration vessel. Crews are usually transported by crew boat, with an average of three crew boat trips per week. As a rule of thumb, helicopters are used for crew changes if the offshore site is beyond 15 miles.

Table 3-1 lists the typical number of trips during offshore exploration activities.

Air Emissions, Wastes, and Waste Disposal

Exploration rigs generally use diesel-driven motors to provide all power needs. Typical volumes of air emissions from exploratory activities are listed in Table 3-2. Wastes generated during offshore exploration for oil and gas include drilling muds and cuttings, water produced from any oil formations, treated sewage, and oily deck runoff. These are similar to those generated during oil/gas development and production and are described in more detail below. Table 3-3 lists representative waste volumes generated during exploration activities, Table 3-4 lists representative waste water requirements for exploratory drilling, and Table 3-5 lists the typical onshore support requirements for exploratory activities.

3.2 OFFSHORE DEVELOPMENT/PRODUCTION ACTIVITIES

If oil and/or gas is found in quantities that are economically recoverable, the development and production phase will be initiated. Major offshore development/production activities include: (1) platform construction, (2) platform installation and hookup, (3) development

Table 3-1

**AVERAGE CREW AND SUPPLY BOAT AND
HELICOPTER TRIPS FOR OFFSHORE OIL
AND GAS DEVELOPMENT ACTIVITIES**

<u>Activity/Phase</u>	<u>Crew Boat Trips</u>	<u>Helicopter Trips^a</u>	<u>Supply Boat Trips</u>
Exploration	3 trips/week/platform	2 trips/day	2 trips/week/platform
Installation	14 trips/week/platform	2 trips/day	1 trip/week/platform
Development Drilling (45 days/well)	14 trips/week/platform	2 trips/day	7 trips/week/platform
Production	7 trips/week/platform	2 trips/day	2 trips/week/platform

- a. As a rule of thumb, helicopters are generally used for crew changes if the offshore site is beyond 15 miles. Management personnel and other officials are likely to be transported by helicopter to sites nearer to shore.

Source: WESTEC 1988, South Coast OCS Marine and Helicopter Marshalling Yard Needs Assessment and Site Location Study for the Port of Long Beach.

Table 3-2

**TYPICAL ATMOSPHERIC EMISSIONS FROM OFFSHORE
OIL AND GAS DEVELOPMENT ACTIVITIES**

<u>Activity/Location</u>	<u>Pollutant (tons per year)</u>				
	<u>RHC</u>	<u>NO_x</u>	<u>SO₂</u>	<u>CO</u>	<u>TSP</u>
Exploratory Drilling - Hypothetical vessel	13.68	123.26	10.81	23.19	9.69
Single Platform Construction - Hypothetical	5.07	89.18	6.86	18.50	8.79
Typical Platform Production:					
- Chevron Platform Gail (Santa Barbara Channel)	58.60	34.69	2.48	17.81	4.36
- Platform Julius (Northern Santa Maria Basin)	126.17	345.96	17.58	166.72	37.47
Crew and Supply Base (Texaco at Gaviota, Santa Barbara County)	31.43	226.59	81.44	136.36	10.22
Marine Terminal (Gaviota Consolidated Terminal)	110.02	127.05	66.91	38.98	12.62
Onshore Oil and Gas Treatment:					
- Chevron at Gaviota, Santa Barbara County	65.92	297.30	40.29	145.16	21.88
- ARCO (Oil Treatment only) at Ellwood, Santa Barbara County	85.01	48.50	0.31	12.32	1.16
- Exxon at Las Flores Canyon, Santa Barbara County	104.22	182.25	57.67	308.39	35.36
Common Carrier Pipeline Pump Station					
- Surf, Santa Barbara County	25.55	18.03	0.18	3.51	0.50
- Orcutt, Santa Barbara County	8.51	6.01	0.08	1.17	0.17

Source: Santa Barbara County 1985

Pollutant Abbreviations: RHC - reactive hydrocarbons
 NO_x - nitrogen oxides
 SO₂ - sulfur dioxide
 CO - carbon monoxide
 TSP - total suspended particulates

Table 3-3

**TYPICAL SOLID WASTES GENERATED BY
OFFSHORE OIL AND GAS DEVELOPMENT ACTIVITIES**

<u>Activity</u>	<u>Waste</u>	<u>Unit</u>	<u>Amount</u>
Exploratory Drilling ^a	Drilling muds and cuttings	Barrels per well	7,000-12,000
Development Drilling	Contaminated drilling muds and cuttings (Requires Class I landfill disposal)	Barrels per day Total barrels	0-75 841-82,143
	Noncontaminated muds and cuttings	Total pounds	45,000-180,000
Oil Processing Facility (60 MBD Capacity) ^b	Hazardous Waste (Class I landfill disposal)	Barrels per year	5,200
Gas Processing Facility (60-80 MMSCFD capacity) ^c	Hazardous Waste (Class I landfill disposal)	Barrels per year	298-2,600
Exploration Drilling	General Refuse	Pounds per person per day	110
Development Drilling	General Refuse	Pounds per day	300-1,180
Production	General Refuse	Pounds per day	140-226
Offshore Pipeline Installation	General Refuse	Pounds per day	400-1,300
Supply and Crew Base Facilities ^d	General Refuse	Pounds per day	200-300

a. Any muds or cuttings which contain free oil are transported to shore and disposed of at an approved landfill.

b. MBD = Thousand Barrels/Day

c. MMSCFD = Million Standard Cubic Ft/Day

d. Excludes what is brought to base from offshore.

Source: MMS 1985a, Facilities Related to OCS Oil and Gas Development Offshore California: A Fact Book.

Table 3-4

**TYPICAL WATER REQUIREMENTS ASSOCIATED WITH
OFFSHORE OIL AND GAS DEVELOPMENT ACTIVITIES**

Activity Requirement	Unit	Amount of Water Needed	
		Potable	Non-Potable
Exploratory Drilling	Total gallons per 10,000 foot well	172,000	466,000
Platform Hookup and Installation	Gallons/day/platform	900	8,300
Development Drilling	Gallons/day/platform	2,100	8,400
Offshore Production	Gallons/day/platform	210	4,200
Offshore Production Worker Related	Gallons/day	2,000 - 20,000	---
Well Work Over	Gallons/day	---	252,000
Pipeline Installation	Gallons/day/pipeline ^a	550	275,000
Pipeline Hydrostatic Testing	Gallons/mile	---	64,092 ^b
Onshore Oil Processing Facility			
Construction	Gallons/day/facility	1,430 - 1,830	2,860 - 3,660 ^c
Operations	Gallons/day/facility	536 - 1,428	---
Population Related ^d	Gallons/day/facility	3,344 - 10,208	
Onshore Gas Processing Facility			
Construction	Gallons/day/ facility	3,850	9,700
Operations	Gallons/day/facility	1,428	39,281
Population Related ^d	Gallons/day/facility	11,616	---
Platform Jacket Assembly Yard			
Construction	Gallons/day	40	63,000 - 75,000
Operations	Gallons/day	5,000 - 10,000	60,000
Crew Boat Trip	Gallons/trip	200	---

a. Offshore/Onshore 12" diameter gas pipeline, 8.5 miles long

b. 18" treated oil pipeline

c. For dust control

d. Related to project-induced growth.

Source: MMS 1985a, Facilities Related to OCS Oil and Gas Development Offshore California: A Fact Book

Table 3-5

**TYPICAL ONSHORE SUPPORT REQUIREMENTS FOR
OFFSHORE OIL AND GAS DEVELOPMENT ACTIVITIES**

Facility	Lease Sale 91 DEIS ^a	MMS Factbook ^b	Cojo Supply Base Permit ^c
Exploratory (Temporary) Supply/Service Base	5-10 acres	Not Available	NA
Exploratory Wharf Space	200 feet	Not Available	NA
Local Supply/Service Base	20-30 acres	25-35 acres	24 acres
Local Wharf Space	600-800 feet	none given: 15-foot water depth for supply boats	1700 feet
San Francisco Service/ Supply Base	40-80 acres	25-35 acres	24 acres
San Francisco Wharf Space	1000-1600 feet	none given; 15-foot water depth for supply boats	1700 feet
Pipeline Right-Of-Way	50-100 feet wide	60-100 feet wide	Not Available
Pipeline Assembly Area	15-40 acres	25-35 acres will store 10-15 miles of pipe	Not Available
Oil and Gas Processing Facility	18-50 acres	2-140 acres	Not Available
Pumping Stations	20 acres each	Not Available	Not Available
Heliport	use existing	Not Available	5,000 sq. ft. helipad
Platform Fabrication	Not Available	100 acres	Not Available
Platform Fabrication Waterfront	Not Available	2,900 feet unobstructed deep water channel	Not Available
			access to ocean

Sources:

a. MMS 1987b, Lease Sale 91 DEIS.b. MMS 1985a, Facilities Related to OCS Oil and Gas Development Offshore California: A Fact Book.

c. Coastal Supply Base Permit Application 1985.

drilling (4) oil and gas production, and (5) air emissions, waste, and waste disposal from platforms. These are discussed below.

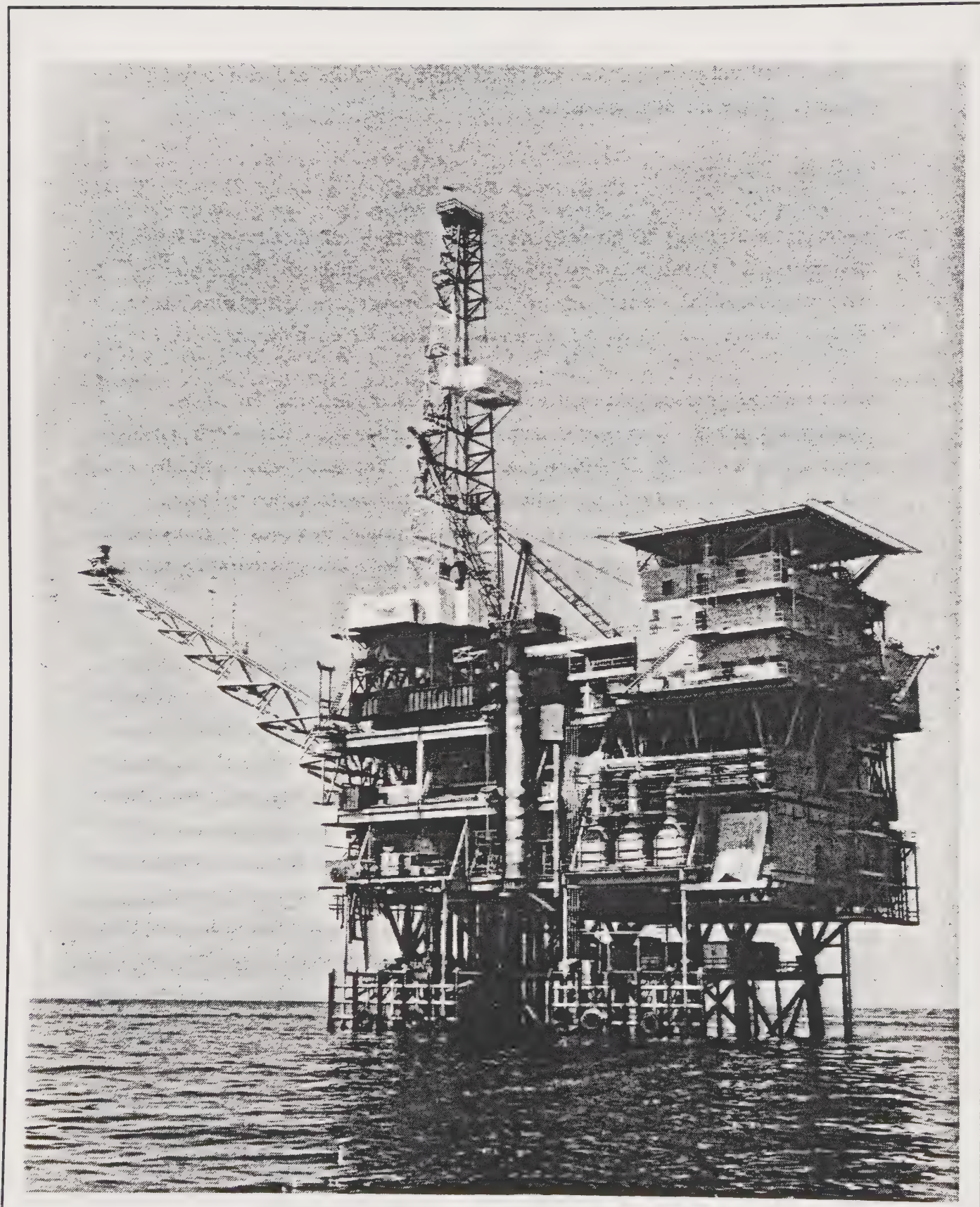
Platform Construction

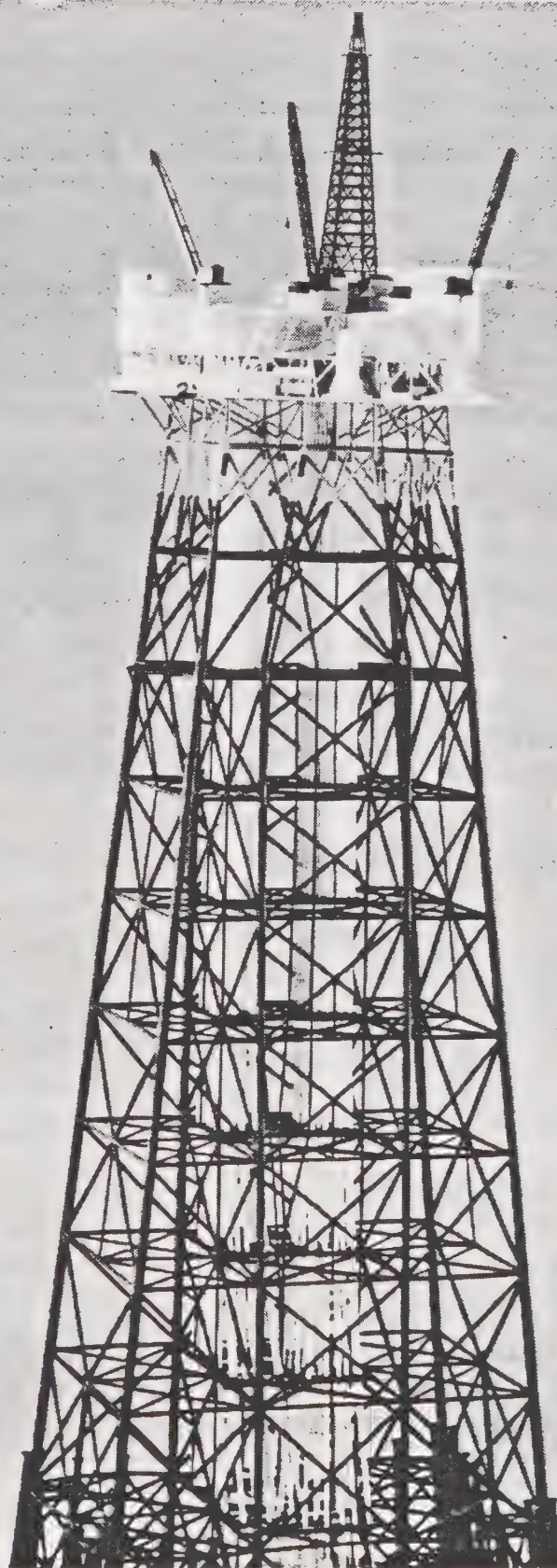
Following the discovery offshore of commercial quantities of hydrocarbons, a company must determine how that discovery will be developed and produced. Where offshore platforms are required, the company will obtain all necessary permits, as discussed in Chapter 2, and request bids for the construction and installation of the platforms.

Site-specific design criteria are used in the construction of platforms. Functional requirements such as size of reserve, number of production wells, water depth, facility specifications, and design life differ for each platform. The design must be flexible enough to accommodate future operational needs, and alternative transportation and storage methods. Platforms must withstand in-place loads generated by waves, currents, marine growth, wind, and earthquakes, as well as installation loads encountered during delivery and deployment at sea.

The typical platform used offshore California is one that rests on the ocean floor and is a steel-template, pile-founded variety composed of a jacket, pilings, conductors, and deck sections (see Figure 3-4). These platforms consist of two parts: the deck and the jacket. The deck assembly includes modular units that can be interchanged for each of the three operations conducted on a production platform: development drilling, production of oil or gas, and well workover (a redrilling process to clean, retool, and or deepen wells to maintain or expand production). The jacket is the larger skeletal framework which serves as the base supporting the deck section (see Figure 3-5). Platform assembly occurs onshore and often occurs overseas; the completed jacket and deck sections are towed to the installation site. In recent years, many of the construction contracts for platforms planned for offshore California have been awarded to Japanese, Korean, or Malaysian contractors because of their cost competitiveness.

Space requirements for fabrication and assembly yards vary; those capable of producing jackets require substantially more space than do fabrication and assembly yards specializing in producing decks or topside modules. Easy access to the open ocean is also a prime consideration because the clearance underneath many bridges restricts the size of jacket that can pass. Because of the volume of work in adjacent offshore areas, most of the existing





fabrication and assembly facilities in the United States are located on the Gulf of Mexico coast. The use of these facilities for constructing California platforms is restricted, however, because the finished product would likely be too large to be transported through the Panama Canal.

Several fabrication and assembly facilities located in California and Washington have been employed for producing decks and jackets. The jackets for southern California platforms Eureka, Henry, Hillhouse, and Hondo were built in Kaiser Steel's Vallejo or Oakland, California, fabrication yards.

Considerably more of the topside construction work for platforms offshore California has been awarded to Pacific Coast yards. Most recently, platform modules for Platform Gail were fabricated by Kaiser Steel at a yard in Stockton, California. Previous deck and module construction was performed by Pacific Coast yards in Oakland, Napa, San Bernardino, and Vallejo, California, and in Anacortes and Vancouver, Washington. Additionally, fabrication facilities in Oregon and Washington have in recent years constructed many of the modules used by the Alaska North Slope oil industry.

Platform Installation and Hookup

The platform jacket is towed to the offshore site (lease tract), upended, and attached to the ocean floor by piles driven through the jacket legs. Deck sections are then welded into place on top of the jacket structure. Platform installation may take several weeks to several months, while hookup generally takes many months. Hookup involves installation of the necessary electrical wiring, piping, structural support, and operating equipment.

Development Drilling

Once the platform is operational, development well drilling is started. Development drilling is undertaken to bring the discovered oil/gas field into production. Production platforms have one or two rigs that drill holes through the ocean floor using a drill bit attached to a string of pipe made of tubular steel. Drilling is both vertical and directional, with the latter being a technique used to develop as much of an oil/gas field as possible from a single platform. Typically, 40 to 60 wells are drilled from each platform; however, some platforms offshore Santa Barbara have the capability to drill up to 90 wells.

Drilling mud is circulated through the inside of each drill pipe to: (1) raise drill cuttings to the surface, (2) cool and lubricate the drill bit, (3) contain underground pressure, and (4) coat the hole wall. Drill cuttings and spent muds are disposed in the ocean if they meet specified EPA waste discharge standards and Ocean Plan requirements. Any contaminated (Class I) hazardous wastes must be transported to shore by supply boat for disposal at appropriate facilities which accept hazardous waste.

Before development drilling begins, various piping, casing and blow-out preventors are installed. During this well-drilling phase, the production platform requires the services of a full drilling crew, numbering approximately 200 workers. However, once the wells have been drilled and production equipment installed, only a few (8-25) operation and maintenance workers are required.

Oil and Gas Production

The production phase of offshore development is where well fluids (oil, gas, and water) are brought to the surface, separated, measured, stored, and ultimately transported to a refinery. Each platform is specifically designed for its location, the characteristics of oil and gas, production rate, and its relationship to onshore facilities. Production platforms contain process equipment, utility systems, safety systems, living quarters, and a helipad. Production of oil and gas from a platform can typically last up to 15 to 20 years.

Air Emissions, Waste, and Waste Disposal from Platforms

During the early phase of development, platforms generally obtain power supplies by use of diesel-driven motors. In some cases, power generation continues through the platform life using diesel-driven sources. In other cases, shore-based electrical power is supplied via subsea cable that is connected to the platform during the hookup phase. To be economically feasible, platforms typically must be located near to shore to be "electrified" by an undersea cable. Table 3-2 lists typical atmospheric emissions for production platforms that do not use land-based electricity.

Solid and liquid waste materials are generated during exploration and development/production activities. Solid waste consists mainly of cuttings from the drilled wells and muds used to lubricate drilling equipment and control well pressure (see Chapter 7, Environmental Issues, for more detail on muds and cuttings). Liquid waste from

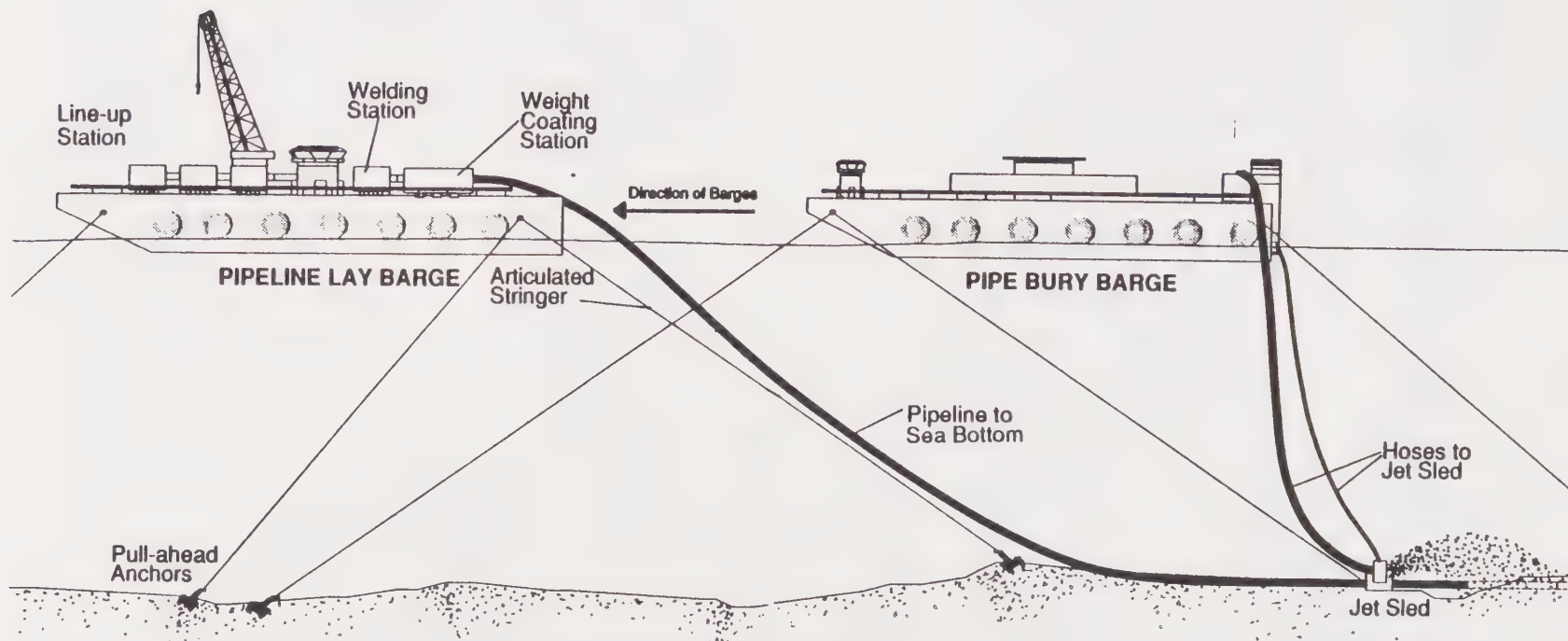
exploration/ production vessels includes cooling water, deck drainage, effluent from air pollution control equipment (if electric power is not used), brine from desalinization units, water produced from the oil formations, and treated sewage. In addition, liquid waste is generated by hydrostatic testing of pipelines, which is done to confirm the integrity of pipeline welds. Nontoxic wastes are discharged into the ocean in accordance with discharge permit conditions. Other wastes are stored in suitable containers on the platforms and then shipped to shore for treatment and/or disposal in approved facilities. Typical waste volumes generated during offshore production activities are listed in Table 3-3.

3.3 OFFSHORE AND ONSHORE PIPELINES

Oil and gas recovered by offshore production facilities is transported either to onshore or offshore processing plants, where it is treated and stored prior to further transportation to refineries or, in the case of gas, to utility distribution networks. Oil and gas pipelines systems include: (1) a pressure source to pump oil/gas through the pipe, (2) a gathering system to bring oil and gas from one or more platforms and/or subsea wells to a tie-in with a larger pipe connected to shore, (3) platform to shore pipeline, (4) intermediate facilities to maintain flow through a pipeline, and (5) the land section of pipeline to an onshore processing plant or end user (in the case of gas).

Subsea Pipelines and Cables

Subsea pipelines are used to transport reservoir fluids to the production platform from remote wells and from the production platform to offshore or onshore processing facilities. These are installed using one of two general installation techniques: pipelay or pipepull. In the pipelay method, pipe sections are welded into a continuous string offshore on a vessel called a lay barge and installed directly from the vessel to the ocean floor (Figure 3-6). An alternative to this is the reel method in which the pipe is welded together onshore, wound onto a spool, transported to the pipeline site, and unwound. In the pipepull method, lengths of pipe are welded together onshore or on a floating barge and then pulled into position by a tugboat or a winch on an anchored barge. This is the method used most often in southern California. Offshore pipelines need a temporary onshore pipe storage yard of several acres. If the line is installed using the reel method, or pipepull method, a temporary onshore pipeline staging area of 3 to 8 acres is required from which to weld and launch the pipeline.



3-19

Corrosion protection is typically provided for all lines, which is generally applied onshore after the pipes are welded together. Externally, all lines will have an extruded polyethylene-over-mastic coating that is resistive to damage from handling. The lines are also cathodically protected using an electric current for corrosion protection. Once in place, a pipeline is hydrostatically tested (filled with water) to check for any leaks.

Pipelines are buried where they pass through the surf zone. They are also often buried for much of their offshore length to provide protection from wave and current forces, undersea mud slides, seismic activity, and anchor damage. Sea floor pipelines that are not buried are required to have a smooth, snag-free external surface to prevent damage to bottom-trawl fishing equipment.

Onshore Pipelines

Onshore pipelines require a 60- to 100-foot wide construction right-of-way (ROW), a corridor of land through which a pipeline is installed, and about a 30 to 50 foot wide ROW during operations. During construction, staging areas (15 to 45 acres) may be needed for storage of equipment and materials. The entire corridor is cleared and graded. An onshore pipeline "spread" includes clearing and grading, ditching, stringing the pipe (lining up the pipeline components), bending the pipe to conform to terrain, welding, application of a protective coating, lowering the pipe into the trench, backfilling, and ROW restoration. The typical pipeline spread for onshore pipelines moves about 1 mile per day. The trench size varies depending on the size of the pipeline, but is usually about 5 feet wide and 4 feet deep (see Figure 3-7). Once an entire section of pipeline is in place, it is hydrostatically tested using fresh or sea water to check for structural integrity.

3.4 OIL AND GAS PROCESSING

Oil, gas, water, and suspended mineral impurities are all pumped out of offshore wells together. A crude oil well stream consists of crude oil, natural gas, and formation water. Formation water consists of brine water, dissolved solids, and suspended solids. Partial processing refers to the separation and removal of impurities and water from the well stream. Generally, natural gas is removed from the well stream at the platform and handled separately. Partial processing usually reduces water content to 3 percent or less so that the crude oil will be acceptable as feedstock at a refinery. Under some circumstances, some or



all of the gas is reinjected into the reservoir to maintain well pressure and enhance oil recovery.

Oil Processing

Processing of the well stream can be performed either offshore, on the platform or at an offshore storage and treatment facility (OS&T), onshore at a separate facility, or a combination of offshore and onshore processing.

If tankers are going to load at an OS&T, processing will occur offshore. If a nearshore marine terminal or onshore pipeline will ultimately transport the oil to a refinery, processing can occur either offshore or onshore.

A number of factors influence the decision as to whether partial oil processing is done offshore or onshore, including availability of suitable onshore sites, the distance between the platform and shore, the characteristics of the well stream, and the relative costs of offshore and onshore facilities. Numerous trade offs must be balanced. For example marine pipelines are very expensive to install, and, therefore, oil companies seek to maximize pipeline efficiency. Pipeline efficiency is lower when partial processing takes place onshore because the pipeline carries a higher percentage of water from the platform to shore. However, space on offshore platforms is also very expensive, particularly if a separate processing platform must be constructed to house the processing equipment.

If the well stream contains a high percentage of water, there is a greater incentive to remove at least some of it before piping the crude to shore. If this is the case, it would be likely that offshore processing would include free water removal and treatment of the free water before it is discharged. If the well stream contained a small percentage of water, there may be little incentive for offshore processing (if all other factors are held constant). In Santa Barbara, Texaco and Chevron reduce the water content of their oil streams to 20 percent offshore at the platform prior to bringing it to their onshore facility for additional processing. One reason they do this is to allow for more accurate metering of commingled oil, which ensures that each company receives proper credit for their share of the processed crude.

For the central coast, key factors which may make offshore processing attractive will include the lack of existing onshore pipelines and the potential difficulty of permitting an

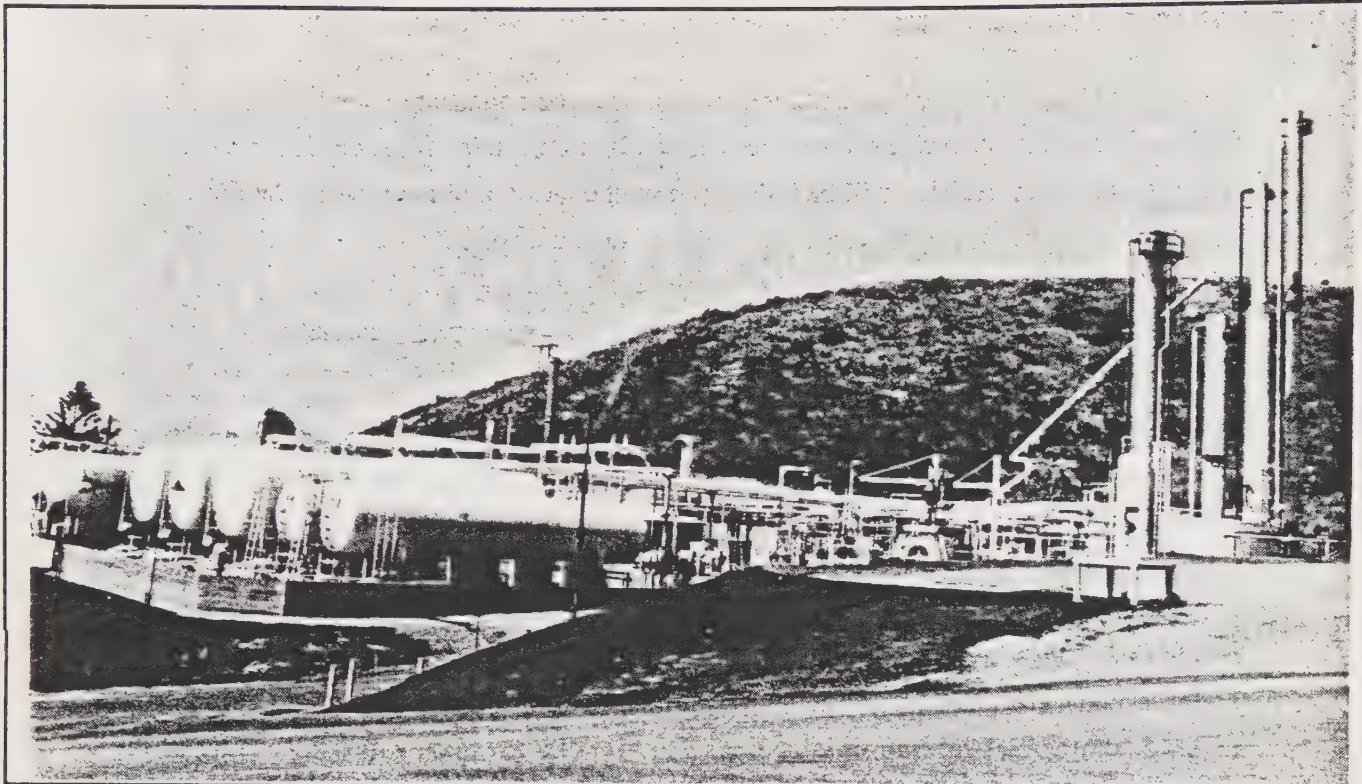
onshore facility. On the other hand, the adverse weather conditions found off the central California coast could make offshore processing less attractive. If processing occurs onshore, the siting decision will be influenced by the location of the pipeline landfall, the availability and environmental sensitivity of land near the coastal landfall, the details of local and state agency environmental regulations, the location of an existing refinery, or, where none exists, the location of an overland pipeline or a marine terminal.


Gas Processing

On the platform the gas is dehydrated (water is removed), compressed, and piped to an onshore facility. Some gas produced from offshore California formations are "sour," containing corrosive and toxic hydrogen sulfide (H_2S) which must be removed during processing. Onshore gas processing facilities strip impurities and valuable liquefiable hydrocarbons, such as ethane, butane, and propane, from the raw gas stream before it enters a commercial gas transmission line. The size of a gas plant varies depending on the processes necessary to clean the gas. Shell's Molino sweet gas processing plant in Santa Barbara County (see Figure 3-8) takes up 3.3 acres on a 50 acre parcel and has a permit to process as much as 30 million standard cubic feet per day (MMSCFD). Currently the facility processes about 3 MMSCFD.

A number of factors influence gas plant siting, including the size of the find, location of commercial transmission lines, and availability of land. On the central coast, physical land availability and access to a commercial transmission line will be the principal determinants of a specific site.

Gas processing plants often are designed to recover natural gas liquids (NGL) such as butane and propane. Butane and propane can be separated from natural gas and sold in liquid form as fuel in rural areas not served by natural gas pipelines. This liquid fuel is commonly known as liquified petroleum gas (LPG). Both LPG and NGL are classified as hazardous materials due to their highly flammable and explosive properties. They can be transported by pipeline, tanker, train, or truck. Pipeline is generally considered to be the safest mode of transportation, yet because pipelines are not always available, NGL and LPG are often transported by truck. Because LPG and NGL are flammable and explosive, transporting by truck on public highways poses a potential risk to public safety.

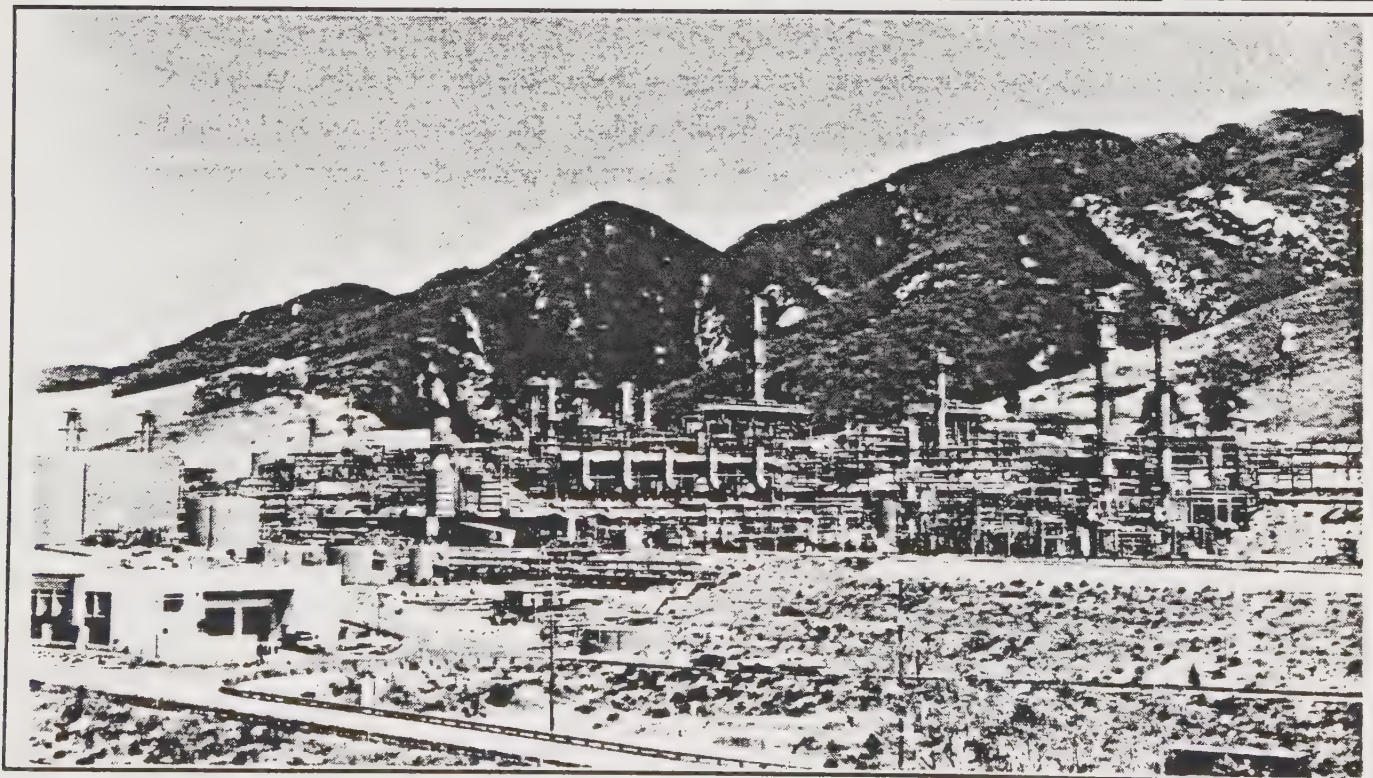




ERC
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Sweet Gas Processing Plant

FIGURE

3-8




ERC
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Oil and Gas Processing Plant

FIGURE

3-9

Oil and Gas Processing Facilities

Although oil and gas can be processed at separate sites, the two systems are often located at one site. A typical onshore oil and gas processing plant is shown in Figure 3-9 and representative emissions are listed in Table 3-2. The Chevron oil and gas processing facility in Santa Barbara County is located on a 62-acre parcel. The Chevron facility's current land use permit capacity is 250,000 BPD for oil and 120 MMSCFD for gas. Other existing facilities for processing OCS production in California range in size from 2 to 140 acres (MMS 1985a).

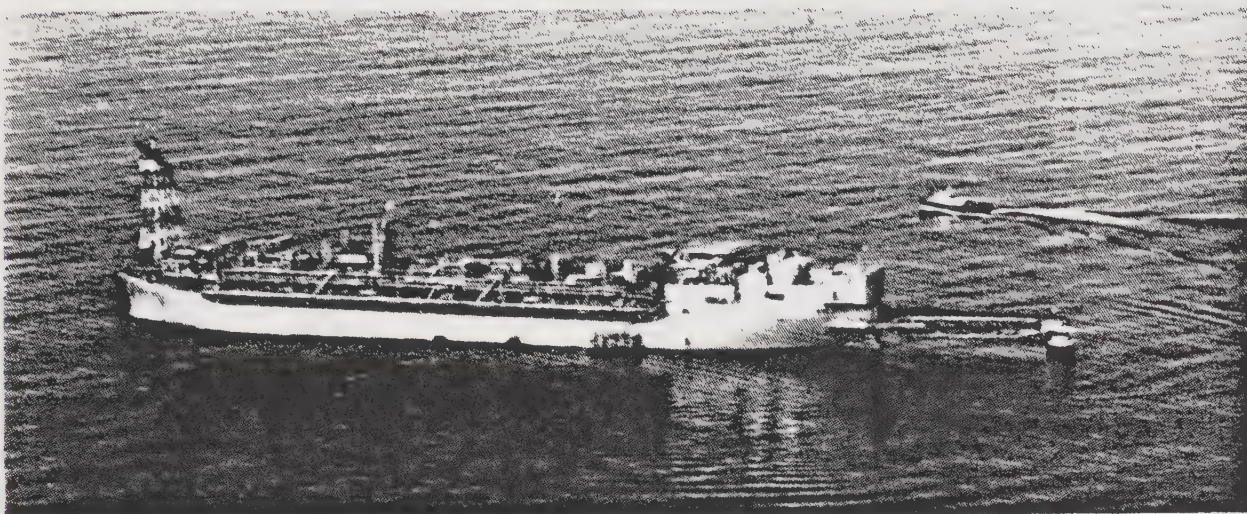
Waste Water Disposal

Produced water from the reservoir (generally up to 40,000 BPD) that is removed from well fluids on platforms is treated, if necessary, and usually discharged to the ocean according to EPA NPDES discharge requirements. Water removed at onshore processing facilities can be disposed of on land, discharged to the ocean via an outfall, or returned to the platform for discharge or injection into abandoned reservoirs. Ocean discharge must be in accordance with regulatory stipulations, which would include the requirement for treatment.

3.5 OFFSHORE STORAGE AND TREATMENT VESSEL (OS&T)

An offshore storage and treatment vessel (OS&T), is a converted oil tanker (approximately 50,000 deadweight tons in size) which is permanently moored offshore by a single anchor leg mooring (SALM) buoy (see Figures 3-10 and 3-11). The only OS&T found in California is Exxon's, located off of Santa Barbara County. An OS&T receives crude oil emulsion from nearby platform(s) via subsea pipeline and processes the stream to prepare it for transportation to a refinery. Tankers can connect to the mooring lines of the SALM and load the processed crude.

A SALM consists of a mooring buoy at the sea surface anchored by a single anchor leg to a base on the sea floor. A swivel assembly at the top of the mooring base allows the tanker to rotate 360 degrees (see Figure 3-12). Off Santa Barbara County, the SALM at Exxon's OS&T is designed to withstand seas of up to 22-foot significant wave height, 65-knot sustained winds, and a 2-knot water current. With a marine vessel moored in tandem, these limits are reduced to a 15-foot significant wave height and 40-knot winds. In the

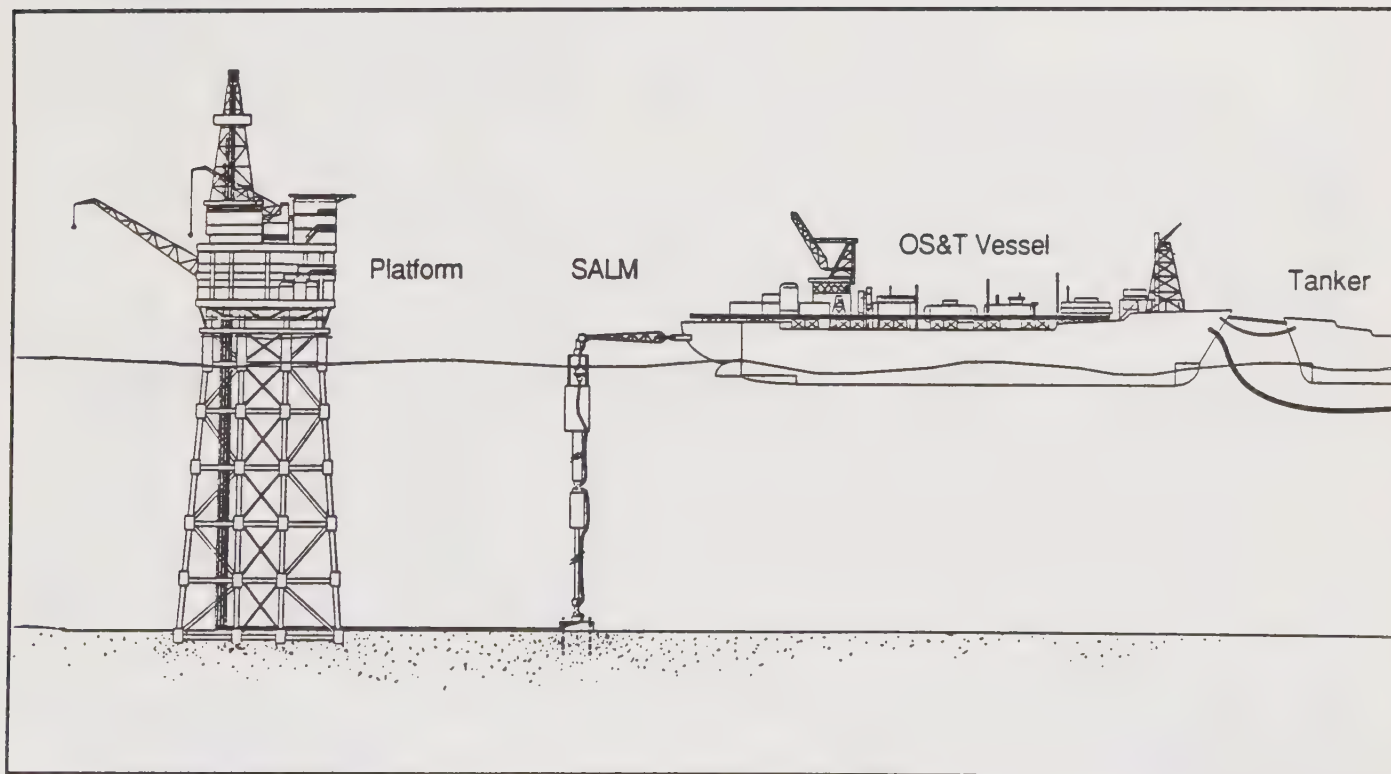


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Offshore Storage and Treatment Facility (OS&T) Photo

FIGURE

3-10

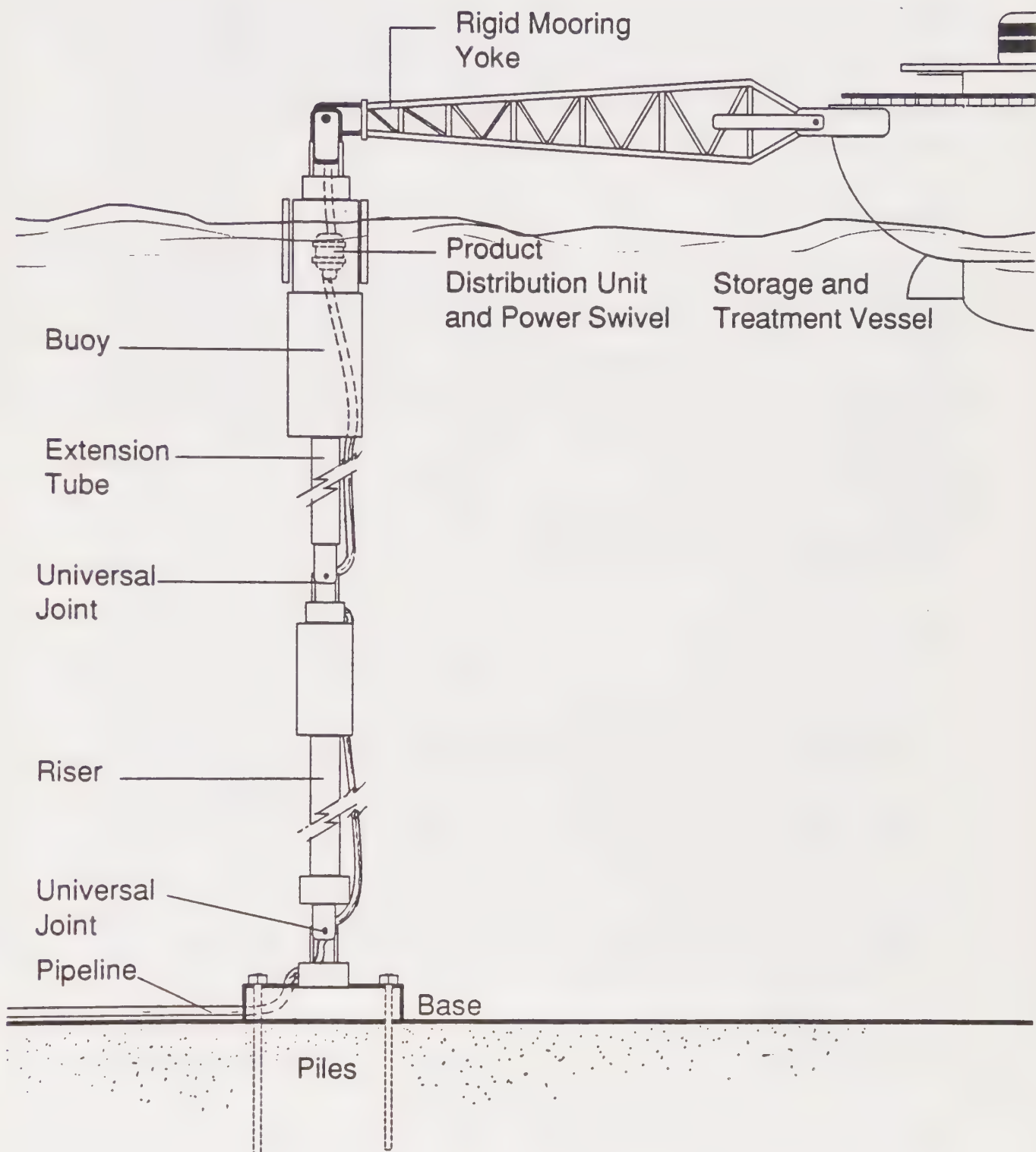


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Offshore Storage and Treatment (OS&T) Facility and
a Single Anchor Leg Mooring (SALM) System

FIGURE

3-11



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Single Anchor Leg Mooring (SALM) System

F I G U R E

3-12

unlikely event that the OS&T should break away from the SALM, self-closing safety valves are located on the three pipelines at the lower and middle universal joints. For the central California coast, an OS&T and SALM would have to be designed to withstand rough weather conditions typically found off the coast (Personal communication, Steve Borys, Exxon 1988).

Processing Facilities

The primary function of the process equipment on an OS&T is to separate free and emulsified water from the crude oil emulsion received from the platform and to remove H₂S and light hydrocarbon gases by stripping the dehydrated crude oil and stabilizers. Gas is either pipelined to shore or reinjected into the reservoir. The gas associated with the oil must be removed prior to shipping. Exxon's OS&T has the capacity to handle 40,000 BPD of oil.

Offshore Support and Utility Systems

An OS&T is equipped with several utility support systems. These include:

1. A circulating hot oil system, heated by waste heat from the two gas-fired turbine generators, which supplies process heat to the OS&T.
2. A circulating water system, cooled by seawater, which supplies process cooling.
3. A flare system which provides for emergency venting requirements.
4. A vapor balance system and a gas blanket system for storage tanks and other atmospheric pressure vessels.
5. Instrument and utility air compressors and dryers.
6. A segregated seawater ballast system.
7. A cargo tank washing system.
8. A sewage treatment unit.
9. Potable water makers.
10. Deck, bilge, and process drain collection systems.

Offshore Electric Power Generation

Electric power for an OS&T is typically generated by gas fired turbine driven generators (Exxon's OS&T uses two 19-MW generators). An 800-kW diesel driven auxiliary

generator is provided for use in starting up the main power plant. A 50-kW diesel driven emergency generator is utilized to automatically provide power for lighting, communications, battery chargers, controls, and safety systems in the event of a main power plant failure.

Offshore Cargo Handling and Transfer Systems

On the OS&T off Santa Barbara, processed crude is stored in six center tanks, with a total capacity of approximately 200,000 barrels. Four cargo pumps located in the main pump room are used to offload cargo to marine vessels.

3.6 OIL TRANSPORTATION OPTIONS

Oil and gas that has been processed (either offshore or onshore) must then be transported to a refinery (or in the case of gas to the utility distribution system). The transportation options for oil and gas are either pipelines or marine tankers. The two methods are discussed below.

Pipelines Versus Marine Terminals

California Coastal Commission policies encourage pipeline transportation over use of marine terminals for tankers because tankers have a greater impact on air quality and increase the opportunities for oil spills (see Appendix B). Historically much of Santa Barbara County's oil has been transported by tanker due to the limited capacity of the existing pipeline systems, high cost of building new pipelines, and desire for flexibility in the final destination of the oil. However, in 1984, Santa Barbara County approved policies which confirmed the county's preference for pipeline transportation of crude oil over any other mode of transportation.

Pipeline Options

Before an onshore oil transportation system is proposed, a number of factors are considered by industry, including:

1. Existing policies which encourage pipeline transportation if feasible;
2. Existing marine terminals in the area and their ability to handle OCS crude;

3. The lack of an existing crude oil pipeline transportation network;
4. Production rates;
5. Crude oil characteristics;
6. Final refinery destination; and
7. Environmental impacts and risks.

A key issue is final refinery destination. Chapter 6 identifies the existing refineries in the San Francisco Bay area and their ability to handle central coast crude. Traditionally, industry has argued that they want to use tankers to transport their crude because marine terminals allow several final destinations, thus maximizing operational flexibility.

If the San Francisco Bay area is the preferred refinery destination, a crude oil pipeline to the refineries could be built. Construction procedures and corridor siting requirements for onshore pipelines were discussed earlier. Onshore pipelines for crude oil and natural gas vary in size and capacity depending on production, quality of the oil and gas, and throughput requirements from the processing plant. Pipelines can range in diameter from 8 to 36 inches and usually have capacities from 35,000 to 350,000 barrels a day. Most pipelines in California are privately owned, which allows companies to set the tariff for use of the pipeline. In comparison, a common carrier pipeline is regulated by the Federal Energy Regulatory Commission and must accept and transport all compatible stock without discrimination. Santa Barbara County has pipeline consolidation policies which encourage new pipelines to be common carrier or multiple-user in order to minimize new pipeline construction.

Marine Terminal Options

Offshore or nearshore marine terminal facilities are used to load (and/or unload) crude oil onto vessels. The onshore components provide storage and support facilities. The use of marine terminals may be an interim strategy until such time as a pipeline to the desired destination is operational. Marine terminals may also be used throughout a project's life. A transportation strategy may call for use or expansion of existing marine terminals or construction of a new facility.

Offshore marine terminal facilities generally use four different types of berthing and mooring arrangements: fixed berth, sea island (offshore pier), single anchor leg mooring (SALM) buoy, and multiple buoy system. Each type of facility has:

- A system to hold a tanker in position;
- A system to transfer cargo from the tanker to shore; and
- A system of underwater pipelines between the tanker berth and shore.

Marine terminals have a series of tanks to store crude oil prior to tanker loading. The capacity of these tank farms is dependent upon the volume and characteristics of crude oil that is to be shipped, the number of individual users, size of tankers, and expected oceanic conditions (greater storage capacity is required when a higher frequency of storm conditions occur that would prevent a tanker from berthing at the terminal). For example, a consolidated marine terminal with a throughput of 150,000 to 300,000 barrels per day would require approximately 16 acres for a tank farm with a storage capacity of 2.7 million barrels (Santa Barbara County et al. 1984). Typically, storage for 7 to 10 days is required at a marine terminal. A functional consideration related to siting storage facilities is the grade and stability of the soil. A flat and stable ground area is needed for storage tanks. A buffer zone is required around the tanks to minimize impacts from potential tank failure. This adds to the need for level ground.

A key locational consideration for marine terminals is proximity of the site to onshore processing facilities. Since pipelines are used to connect the processing facilities to a marine terminal, the greater the distance between processing facilities and the marine terminal, the longer the connecting pipelines. The mooring or berth for a marine terminal must be in water deep enough to allow tanker access.

Crude oil tankers vary in size depending on the volume of oil to be transported and the destination of the oil. Barges powered by tug boats are used to transport smaller volumes for shorter distances. Tankers ranging in size from 17,000 dead weight tons (DWT) to 150,000 DWT and larger are common along the west coast. On the average, a 50,000 DWT tanker has a capacity of approximately 365,000 barrels and an average pumping rate of 30,000 barrels an hour (Getty 1983). Table 3-6 shows the capacity, loaded draft, and pumping rates for tankers ranging from 30,000 to 300,000 DWT.

Table 3-6

TANKER DIMENSIONS AND PUMPING RATES

Tanker Sizes (x 1,000)		<u>Loaded Draft (ft.)</u>	<u>Pumping Rates (Barrels per Hour)</u>
<u>DWT</u>	<u>Barrels</u>		
30	210	35	21,000
40	280	37	28,000
50	365	39	30,000
60	420	40	35,000
70	490	41	42,000
300	2,100	70	140,000

Source: Getty 1983

3.7 SUPPORT FACILITIES

Offshore oil/gas exploration, development, and production requires various onshore support such as crew and supply bases, heliports, electrical power, fresh water, and waste disposal. Each of these activities are discussed below.

Supply and Crew Bases

A supply base is used for transferring heavy equipment and supplies by boat to offshore platforms. It provides facilities for boat berthage, loading/unloading, warehousing, open storage, and parking. Light equipment and personnel are transferred from a crew base. Both boats and helicopters are used for transferring personnel and supplies. Crew bases can be located at the same site as a supply base, at a separate pier, or at a helicopter landing area. A separate crew base includes a pier, parking, and security arrangements. Additional features might include mooring buoys, office space, waiting lounges, and perhaps a warehouse and helipad. Crew and supply bases operate seven days a week year round.

The arrangements used for onshore support of California offshore oil and gas activity differ depending upon the oil company and location of the offshore site. In general, the arrangements take two forms. Either an existing port is used as a supply and crew base, with non-oil related industry uses at the same port or an existing port is used only as a supply base and the oil company uses a pier as the crew base. Helicopter service is usually provided at a separate site.

The level of activity at supply and crew bases and their size of operation reflect the level of offshore oil and gas activity. Exploratory and development drilling requires more supplies and onshore logistical support than production. The number of boat trips needed to support offshore activity depends not only on the phase of activity but on such factors as storage capacity of the exploratory drilling rig or development platform (see Table 3-1).

Estimates of the number of boat trips needed by phase of development vary. One reason is that actual trip generation can include some shared service to platforms belonging to the same company or single trips to cooperative projects in close proximity to one another. Isolated platforms may require fewer crew boat trips per week (longer crew shifts). A generic estimate of the frequency of boat trips by phase is as follows:

- Exploratory Drilling - three crew boat trips per week and two supply boat trips per week.
- Development Drilling - seven crew boat trips per platform per week, seven supply boat trips per platform per week, and two helicopter trips per day per platform.
- Platform Production - seven crew boat trips per platform per week, two supply boat trips per platform per week and two helicopter trips per day per platform.

Factors which influence the selection of crew and supply base sites include (1) access and short travel distance to major offshore development areas; (2) proximity to onshore railroads and highways; (3) safe wind, wave, and navigational conditions for pier and boat operations; (4) adequate sources of fresh water and access to waste disposal facilities; and (5) sufficient land (up to 35 acres) available for development as a supply base. Table 3-5 lists typical site requirements for crew and supply bases. Along the central coast, crew and supply bases will most likely be located at existing ports and harbors.

Heliports

Helicopters also transport personnel and needed parts to drilling rigs and platforms. They may be the major mode of transportation for light supplies and personnel. Alternatively, they are used on an "as needed" or emergency only basis. In California, the mode of transportation used for crew transfer is dependent upon a number of factors including oil

company access to piers, distance from available piers to the platform, cost, and location of the platform versus sea state conditions. As a rule of thumb, helicopters are generally used for crew changes if the offshore site is beyond 15 miles (MMS 1985a). Management personnel and other officials are likely to be transported by helicopter to sites nearer to shore. Typical frequencies of helicopter flights to offshore platforms are listed in Table 3-1.

Helicopter companies serving the offshore oil and gas industry in California are generally based at airports in the area where offshore activity is occurring. However, helicopter companies do not need to be based at an airport. In central California, the majority of heliports are privately owned (see Chapter 6).

Electrical Power

Electricity is often used to power offshore production facilities where it is feasible to connect the facility with an undersea cable from a land-based transmission end-point or power plant. Use of electricity largely eliminates atmospheric emissions from production facilities, and reduces the volume of fuel that would otherwise have to be shipped offshore. In some cases, it may be possible for large shore-based gas processing plants to cogenerate electricity to meet power needs of these plants and transmit any excess power to offshore facilities.

Fresh Water

Potable water is required offshore for domestic purposes (cooking and hygiene or sanitary needs), in the preparation of some drilling muds, and for emission control of diesel-powered turbines. Much of this water will have to be supplied from onshore sources, although many production platforms will install desalinization units to operate once hookup has been completed. Typical volumes of fresh water requirements are listed in Table 3-4.

Waste Disposal

Offshore oil and gas activities generate some solid wastes that will not be permitted by agencies for ocean disposal. Such wastes must be shipped to shore and then hauled via approved transportation means to appropriate disposal facilities. Typical volumes of such

waste are listed in Table 3-3. Contaminated drilling muds and cuttings require Class I landfill disposal.

3.8 REFINERIES AND PETROCHEMICAL PLANTS

Crude oil from processing plants is delivered to refineries for processing into marketable products. Feedstocks from refineries or natural gas processing plants are delivered to petrochemical plants for production of various petroleum-based chemicals and products.

Refineries in the United States tend to be located near either crude oil production facilities or population centers. Petrochemical plants are generally located near refineries, often within the same overall facility. In California, refining capacity is mainly located in the populated areas of the San Francisco and Los Angeles regions, and the oil producing portions of San Joaquin Valley.

Refineries

Partially processed petroleum contains hydrocarbon compounds with a range of boiling points, and various amounts of oxygen, sulfur, nitrogen, salt, water, and trace metals. A refinery separates the natural components into marketable products such as diesel fuel, lubricating oil, fuel oil, asphalt, and propane. The refining process includes a number of interdependent operations which receive crude oil, separate it into components, and blend the components into petroleum-derived products. Process configurations vary from refinery to refinery and are chosen, arranged, and interrelated based on the type of crude being processed and the products produced. Thus, the type and size of processing units vary. Although in theory any petroleum product can be produced from any type of crude, a refinery is designed to make the most efficient use of the characteristics of available crude oil and to meet demand for products produced.

In addition to the process area, refineries include storage facilities and auxiliary buildings for offices, an electrical substation, a dispensary, fire fighting equipment, etc. A refinery complex also includes transportation systems for road, rail, and pipeline access.

A significant characteristic of refineries is the large amount of land used for the site. The process equipment site occupies only a portion of the entire land area. Many times the land devoted to processing may be used for storage and wastewater treatment. A buffer zone

separating the refinery from adjacent properties adds to the total land needs. This additional land can also be used for expansion purposes and increase of the complexity of refining capabilities. A refinery in the 250,000 barrels per day range is likely to require 1000 to 1500 acres of clear, flat, industrially zoned land; of this total, about 200 acres is required for the actual processing unit (RALI 1977). The amount of land used for storage depends on several considerations including crude delivery, product delivery, refinery complexity, seasonal demand, shutdown time, and number of feedstocks used.

Petrochemical Plants

Petrochemicals are relatively pure chemical substances derived from petroleum and natural gas, and can be divided into three broad categories: (1) aliphatics, (2) aromatics, and (3) inorganics. The aliphatics and aromatics are organic, or carbon-based, compounds. The aliphatics are either straight or branched chain or alicyclic compounds. They can be divided into two classes: paraffins which are saturated compounds, and olefins which are unsaturated.

The processing of petrochemicals occurs in three stages. First, primary petrochemicals are derived from feedstocks produced by either petroleum refineries or natural gas processing plants. Primary petrochemicals are then converted into intermediate petrochemicals or directly into finished products. Finally, the intermediate petrochemicals are converted into finished products.

Petrochemical plants are often located near refineries because the petroleum feedstocks used are produced in refineries. Like refineries, petrochemical plants use large amounts of land. A proposed site for a petrochemical plant in California included 2800 acres (Williams and Massa 1983). The processing and storage facilities account for only a portion of the land. A buffer area is usually provided between the industrial site and adjacent properties.

3.9 ABANDONMENT

When hydrocarbon reserves have been depleted, all wells must be abandoned in the manner prescribed by agency regulations and lease requirements. Platform equipment is disassembled and transported to a shore base for reuse or disposal. Decks are cut into sections, removed, and hauled ashore for disposal as scrap. Pilings are cut off below the mudline and the jacket refloated by use of packers set in the jacket legs and displacement of

the water with air. Jackets are then towed to shallow, sheltered water where they would be cut up for salvage. The seafloor is left with no obstructions. Pipelines are abandoned in place after purging with seawater and filling with an inert liquid such as a barite-water mixture; onshore facilities are dismantled and removed. All termination and abandonment procedures would be conducted in conformance with agency regulations and procedures in effect at the time these activities are warranted.



CHAPTER 4

CHAPTER 4

OIL AND GAS ESTIMATES FOR CENTRAL CALIFORNIA OCS

4.1 OVERVIEW

This chapter attempts to answer the question "is there oil out there?" and if so, how much. ERCE and its petroleum geology consultants, Crouch, Bachman and Associates (CBA) have prepared an independent estimate of economically recoverable volumes of oil and gas from Lease Sale 119 tracts and in turn, used these estimates to determine the potential for oil and gas development off of central California. This section includes:

- The general locations of offshore geologic formations that may contain commercially recoverable quantities of oil and gas;
- Volumes and characteristics of the oil and gas that might be found in these structures; and
- A comparison between this study's reserve estimates for Lease Sale 119 with those given by the MMS in their recently released Five-Year OCS Leasing Plan.

Before proceeding with this discussion it is important to note that estimating recoverable oil and gas reserves in an area not yet tested is a probabilistic exercise, the accuracy of which is strongly dependent on the quantity and quality of available information. In this regard, the reader should bear in mind that uncertainties and gaps in information related to the petroleum potential of the Lease Sale 119 area still remain. ERCE's estimates should be taken as knowledgeable guesses and used only for preliminary planning purposes. ERCE's Lease Sale 119 resource estimates were, however, reviewed by ARCO Oil & Gas Company; they reported that based on their knowledge of the area, our estimates appeared reasonable (Personal communication, Richard Ranger, ARCO, July 1988).

4.2 PROPOSED LEASE SALE AREA

Offshore Basins

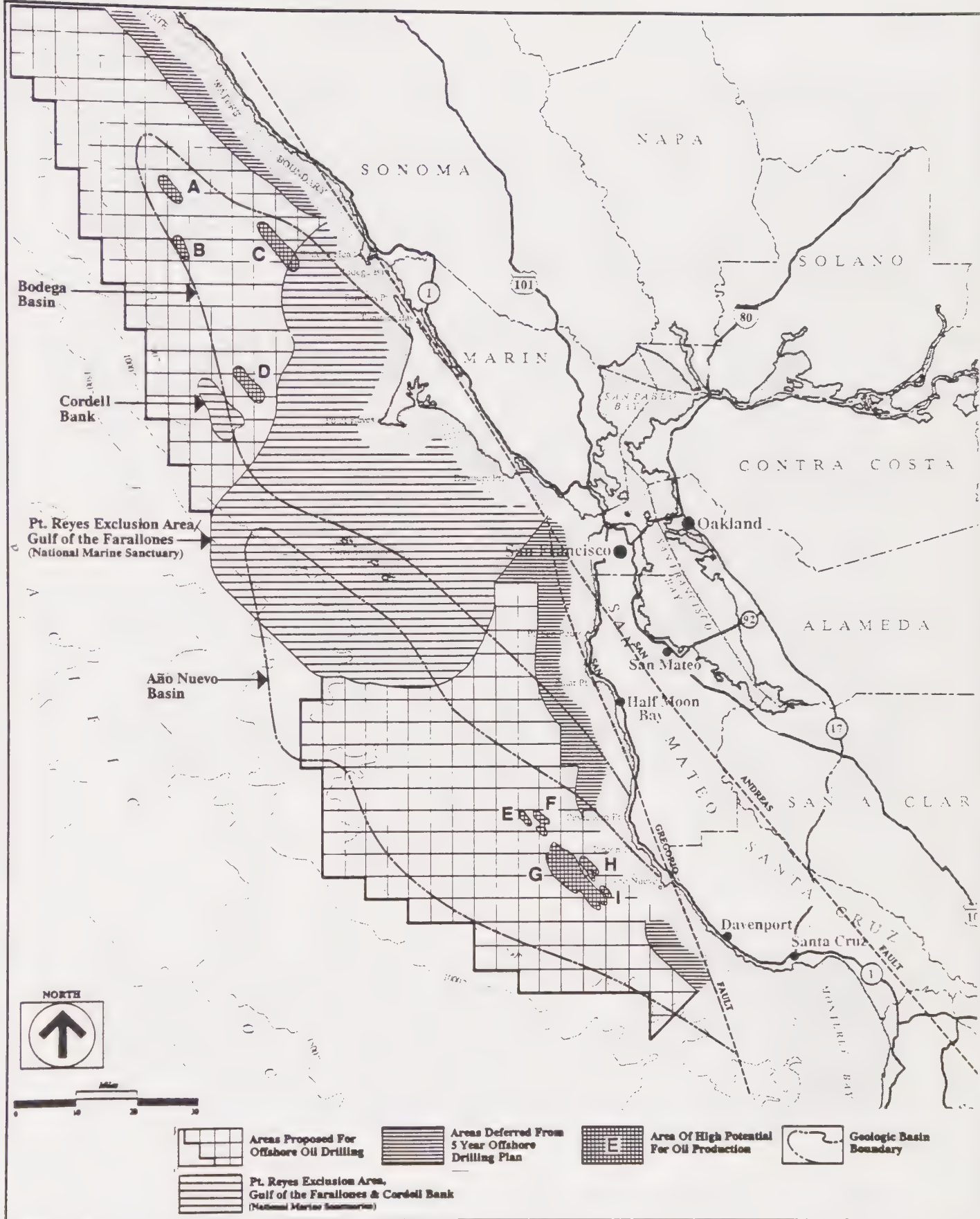
As it is currently planned, approximately 327 lease tracts or blocks may be offered for Lease Sale 119 (see Figure 4-1). These leases are located chiefly within two offshore basins. They include: the northern Bodega Basin, with proposed lease blocks mainly off the Sonoma County coast and the southern Año Nuevo Basin with blocks off the San Mateo County and Santa Cruz County coastal areas.

The MMS has tentatively identified Bodega and La Honda basins as separate basins. However, because structurally they are one basin, we have treated them as one basin in this report and referred to it as the Bodega Basin. The Bodega Basin in the proposed Lease Sale 119 area, encompasses about 146 whole or partial blocks (about 700,000 acres), 16 blocks of which may still be deferred for military (Department of Defense) reasons. Water depths within the sale area of the Bodega Basin range from 30 to 1750 meters (100 to 5700 feet), but are generally less than 250 meters (600 feet).

The Año Nuevo Basin portion of the proposed Lease Sale 119 area includes about 181 whole or partial blocks (about 850,000 acres), of which about 50 are still being considered for deferral pending an agreement with the Department of Defense. Water depths in much of the prospective portion of the Año Nuevo Basin sale area are generally less than 150 meters (500 feet).

It should be noted, however, that both the sale area and number of tracts shown may change, either with the release by the MMS of the Area Identification for Lease Sale 119 and/or the Final EIS, which are respectively scheduled for release in February 1989 and August 1990. Nevertheless, we believe that Figure 4-1, give or take a few tracts, is probably a fairly accurate depiction of the lease blocks that will most likely be proposed in the final Lease Sale 119 recommendations.¹

¹ A Draft EIS for Lease Sale 119 will not be issued by the MMS until January of 1990. However, information pertinent to the Lease Sale 119 area, such as geology, reserve estimates, and development scenarios, were issued in January of 1987 as part of the MMS report entitled, Proposed Five-Year Outer Continental Shelf Oil and Gas Leasing Program Mid-1987 to Mid-1992 (Minerals Management Service 1987).



Deferrals

The Secretary of the Interior may remove tracts from the lease sale area; once removed, these areas are called "deferrals." The proposed deferrals in the Final Five-Year Leasing Program included deep water areas generally beyond the 1000-meter isobath and other sensitive areas. The areas recommended for deferral include:

- 110 blocks off Point Reyes National Seashore;
- 157 full and partial blocks in the area of the Point Reyes-Farallon Islands National Marine Sanctuary;
- 8 full and partial blocks around Cordell Bank;
- 17 blocks outside the San Francisco Bay;
- 104 full and partial blocks in the area of Monterey Bay;
- 460 full and partial blocks in the area of Big Sur; and
- All blocks in water depths greater than 1000 meters.

The State of California has designated the state waters off the six central coast counties as an oil and gas sanctuary which limits oil and gas development activities. Also recommended for deferral, but not discussed in the proposed Five-Year Plan, are expanded "buffer zones" off the Sonoma, San Mateo, and Santa Cruz County coastlines. Additional blocks in the Lease Sale 119 area may also be deferred, subject to agreement with the Department of Defense.

4.3 BASIN HISTORY AND PETROLEUM POTENTIAL

One can gain an understanding of offshore geology by examining information from past exploration wells and by extrapolating from onshore geology. Crouch, Bachman and Associates (CBA) discusses the regional geology of the basins in detail in their report Geologic Summary of the Proposed OCS Lease Sale 119 Area with Estimates of Reserves and Development prepared for ERCE and the Central Coast Counties Regional Studies Program (March 1988). A brief summary is presented here, but the reader is encouraged to refer to CBA's report for more detailed information.

During the mid-1960s, when the wells were drilled in the offshore Bodega and Año Nuevo basins, the price of oil was less than \$2 per barrel and oil industry explorationists generally regarded the Monterey Formation's viscous oil to be an uneconomic target. However, with

the recent discoveries of giant Monterey fields in the Santa Barbara Channel and offshore Santa Maria Basin, industry's perception of the Monterey Formation has changed dramatically (CBA 1988).

Bodega Basin

The Bodega Basin is an elongated basin that extends from Half Moon Bay to about 50 miles beyond Point Reyes. However, much of the southern portion of this basin, which generally lies off San Francisco Bay, has tentatively been removed from Lease Sale 119. Shell Oil Company drilled 10 wells, from 9 locations in the offshore Bodega Basin in the mid-1960s. These wells, along with extrapolations of the onshore stratigraphy, form the basis of our knowledge of the offshore stratigraphy. A Monterey Formation was present at each well site and in general, anticlinal folds in the Bodega Basin make up the primary exploration targets.²

The petroleum potential of the Bodega Basin is somewhat uncertain. In at least 9 of the 10 wells drilled in the Bodega Basin, the Monterey Formation is generally less than 500 feet thick and has apparently been thinned by erosion. Other potential targets within the offshore Bodega Basin include sandstones within the Paleocene, lower Miocene, and upper Miocene sections. However, oil shows within these units were not very encouraging. In terms of yielding commercial petroleum, better reservoir and source rocks may be present in the southern La Honda portion of the basin. However, much of this portion of the basin, which generally lies off San Francisco Bay, has tentatively been removed from Lease Sale 119.

Año Nuevo Basin

The Año Nuevo Basin extends northwest from the vicinity of Monterey Bay for about 70 miles. If Lease Sale 119 takes place, this basin will most likely be an attractive exploration target because it is situated in relatively shallow water depths (less than 500 feet) and because Monterey-like strata that appear oil rich, are present throughout most of the basin. In the middle 1960s Shell Oil Company drilled two exploratory wells in the

² In the Santa Barbara offshore basins, most of the oil production is from reservoirs of the Monterey Formation. Refer to CBA 1988 for a detailed discussion of offshore stratigraphy.

Año Nuevo Basin. These two exploratory wells, along with extrapolations of onshore stratigraphy, form the basis for our understanding of the offshore stratigraphy.

In contrast to the uncertainty of the Bodega Basin, the offshore Año Nuevo Basin appears to have excellent potential for commercial discoveries of oil and gas. Both of the offshore wells penetrated thick, highly-fractured Monterey sections. Abundant oil shows were noted throughout the Monterey in both wells, and within the Vaqueros section of the first well drilled on lease P-036. Besides the Vaqueros Sandstone and fractured Monterey sections, the upper Miocene Santa Margarita Sandstones may also be a reservoir target. The thick clay-rich sediments that make up the Santa Cruz Mudstone should provide an excellent seal or cap rock to underlying reservoir sections.

4.4 OIL AND GAS RESERVE ESTIMATES

ERCE teamed with CBA to conduct an "independent" evaluation of the geologic structures in the offshore Bodega and Año Nuevo basins to determine the potential for oil and gas reserves within the proposed Lease Sale 119 area. This section summarizes our estimates of recoverable reserves for the base- and high-case scenarios and discusses the assumptions used for each scenario.

Method of Assessment

There are a variety of available methods for estimating oil and gas resources prior to drilling. The oil and gas source estimates and oil development scenarios presented in this report are based on comparisons to known production or tested fields that are geologically analogous to the offshore Bodega and Año Nuevo basins. These "analog fields" provide reliable test and production data for assessing resources and development data in the Lease Sale 119 area. The analog method used in this report is considered to be one of the more reliable approaches because it utilizes geologic knowledge from a similar (analog) basin that has already been explored. In simple terms, this assessment by analogy follows the assumption that if untested area A looks geologically like known producing area B, then it should have a similar oil and gas content. The latter is generally expressed in terms of a recovery factor (i.e., barrels/acre-foot for oil and million cubic feet/acre-foot for gas) because not all of the hydrocarbons in place are recoverable. Typically, only about 20 percent of the oil and associated gas in place has been recovered in the types of conventional fields considered here.

Both the Bodega and Año Nuevo basins bear a strong geologic resemblance to the highly productive and recently developed Santa Maria basin in offshore Santa Barbara and San Luis Obispo counties . In addition, the Monterey Formation, which constitutes the principal source and reservoir section in the offshore Santa Maria Basin, underlies buried structures in the offshore Bodega and Año Nuevo basins as well. For these reasons, and because modern drilling, testing, and producing techniques are being employed in developing the resources on the offshore Santa Maria basin fields, we have used test and production data from these fields in order to develop an analog for the offshore Bodega and Año Nuevo basins.

As a result of development plans in the offshore Santa Maria basin, an extensive amount of reliable information has been made public in the past several year.³ In terms of analog basin information needed for evaluating the offshore basins, in the proposed Lease Sale 119 area, the most important parameters are average pay thickness, recovery factor, and the gas-oil ratio (GOR). We used the data from the Santa Maria basin, along with other pertinent onshore and offshore data, to arrive at the following range of analog parameters (CBA 1988):

Average Monterey Pay Thickness		-----	900-1000 ft
Recovery Factory	high	-----	75 bbl/ac-ft
	mean	-----	60 bbl/ac-ft
	low	-----	45 bbl/ac-ft
Gas-Oil Ratio	high	-----	600 cu. ft/bbl
	mean	-----	350 cu. ft/bbl
	low	-----	200 cu. ft/bbl

Size and Location of Offshore Structures

CBA mapped potential geologic structures⁴ within the proposed Lease Sale 119 area in the offshore Bodega and Año Nuevo basins using seismic-reflection data. The southern

³ For a detailed review of actual production records, see CBA 1988.

⁴ Structures being defined as the geologic area where hydrocarbons could be formed.

portion of the Bodega basin may contain commercial quantities of oil and gas, however much of this portion of the basin, which generally lies off San Francisco Bay, has tentatively been removed from Lease Sale 119. Therefore, it is possible that additional structures may exist outside the proposed lease sale area discussed in this report. Mapping was accomplished by contouring recognizable horizons within the basin. In both basins, the near top of the Monterey Formation was mapped. This horizon is middle to upper Miocene in age and constitutes the major reservoir target in the basins. General outlines of the mapped geologic structures in the offshore Bodega and Año Nuevo basins are shown on Figure 4-1.

Four structures were identified within the proposed Lease Sale 119 area of the offshore Bodega Basin. The estimated areal size of the closure⁵ of these structures at the top of the Monterey horizon is summarized as follows:

Bodega Structures		
<u>Structures</u>	<u>Areal Size (acres)</u>	<u>Water Depth (feet)</u>
A	1,490	600-800
B	960	780-850
C	6,350	350-400
D	2,100	450-650

The Lease Sale 119 area of the offshore Año Nuevo Basin encompasses five structures that are evaluated in this report. These structures are clustered in the southern half of the lease sale area, roughly between Point Año Nuevo and Point Pescadero. Other structures are present within the offshore Año Nuevo Basin sale area that are not included in our reserve estimates (e.g., circled areas outside of letter designated structures). These additional structures are small in area size and exhibit very low topographic relief. Hence, structures outside those designated by letters were not considered for evaluation. The estimated area size of closure at the Monterey horizon of structures within the offshore Año Nuevo Basin is as follows:

⁵ Closure being defined as the maximum limit of possible area in which hydrocarbons could be trapped.

Año Nuevo Structures

<u>Structures</u>	<u>Areal Size (acres)</u>	<u>Water Depth (feet)</u>
E	800	320-340
F	1,850	290-320
G	11,100	270-330
H	1700	300-330
I	670	290-310

Minimum Structure Size

The minimum amount of reserves required for an offshore structure to be an economically viable target is a somewhat subjective estimate and may vary considerably among various petroleum companies. Numerous variables must be considered. These include water depth, oil gravity, distance from shore, proximity to larger producible structures (i.e., where a smaller structure can be developed from a platform on a neighboring structure), presence or absence of onshore processing facilities and/or pipelines, and estimates of future oil prices.

For the purposes of this report, we have chosen a somewhat arbitrary cutoff of 30 million barrels (high estimate) for a structure to be economic. Given today's oil prices and current predictions of lower future oil prices, this minimum threshold may be higher. However, structures with slightly higher reserve estimates (e.g., structure P in the offshore Año Nuevo Basin) are close to structures with large reserve estimates. Hence, the most likely scenario would be that these smaller structures could be produced from a platform on neighboring larger structures.

Estimated Oil Reserves

This section provides an estimate of oil reserves within the proposed Lease Sale 119 area and does not analyze areas proposed for deferral. The Año Nuevo Basin appears to have a higher petroleum potential than the Bodega Basin. The lower petroleum estimates of the Bodega Basin result from previous drilling and test results which indicate the formation is less oil-rich than the Año Nuevo Basin to the south. In addition, large parts of the Bodega Basin have been recommended for deferral by the Secretary of Interior. As a result, within the basin, fewer structures which have potential for petroleum development remain in the recommended Lease Sale 119 area. As discussed earlier, the southern portion of the La

Honda Basin may contain oil and gas resources; however, this area has been proposed as a deferred area and therefore not considered in our estimates.

For both the offshore Bodega and Año Nuevo basins, we have estimated the volume of reservoir (in millions of acre-feet) for each offshore structure by multiplying the cross-sectional area (in acres) by the length of the structural closure (in feet). These volumes have in turn been multiplied by the range of Monterey Formation recovery factors (45, 60, and 75 bbl/ac-ft) determined from the Santa Maria Basin in order to arrive at low, mean, and high estimates of recoverable reserves.

As evidenced by the offshore Santa Maria Basin, as well as almost all other petroleum producing provinces in the world, not all structures will be productive. In order to take this fact into account, our final low, mean, and high recoverable reserve estimates are based on the number of structures that might be productive in accordance with approximate discovery success ratios in the offshore Santa Maria Basin. Based on our knowledge of producing versus nonproducing structures in the offshore and onshore Santa Maria Basin, we have assumed that in a low case estimate only 25 percent of the structures will be productive and that in a mean (base) and high case estimate, respectively, 50 percent and 75 percent of the structures will be productive.

Offshore Bodega Basin

On the basis of analog data from the offshore Santa Maria Basin fields, the estimated total reserves for the mapped offshore Bodega Basin structures are listed in Table 4-1. Of the four structures analyzed, all but structure "B" appear to contain adequate reserves to be "economically recoverable" targets in the high scenario, as shown in Table 4-2. By comparison to the ratio of productive structures in the offshore Santa Maria Basin, we have arrived at the following assumptions: a low estimate that 25 percent or one out of the four structures will be economically recoverable; a mean estimate that 50 percent or two out of the four structures will be economically recoverable; and a high estimate that 75 percent or three out of the four structures will be economically recoverable.

Offshore Año Nuevo Basin

Our reserve estimate totals for the offshore Año Nuevo Basin are also listed on Table 4-1, while economically recoverable reserves are shown in Table 4-2. These reserve estimates

Table 4-1

**TOTAL ESTIMATED OIL RESERVES FOR
CENTRAL CALIFORNIA OCS**

<u>Basin</u>	<u>Structure</u>	<u>Volume (in Million Acre-ft)</u>	<u>Estimated Oil Reserves in Million Barrels</u>		
			<u>Low</u>	<u>Most Likely</u>	<u>High</u>
Bodega	A	0.60	26	36	45
	B	0.34	15	20	25
	C	1.20	54	72	90
	D	<u>0.79</u>	<u>35</u>	<u>47</u>	<u>60</u>
	Subtotal	2.93	130	175	220
Año Nuevo	E-F	0.57	25	35	43
	G	6.70	300	400	500
	H	0.48	22	30	35
	I	<u>0.33</u>	<u>15</u>	<u>20</u>	<u>25</u>
	Subtotal	8.08	362	485	603
Grand Total		11.01	492	660	823

Note: Estimates are based on estimated volume of structures. Estimated reserves vary, based on the assumptions used; the low estimate assumes a structure volume of 45 bbl/ac-ft, most likely assumes 60 bbl/ac-ft, and high assumes 75 bbl/ac-ft.

Source: ERCE and Crouch, Bachman and Associates 1988.

Table 4-2
ECONOMICALLY RECOVERABLE OIL RESERVES
FOR CENTRAL CALIFORNIA OCS

<u>Basin</u>	<u>Structure</u>	Economically (Uneconomically) Recoverable Reserves in Million Barrels		
		<u>Low</u>	<u>Most Likely</u>	<u>High</u>
Bodega	A	(26)	(36)	45
	B	(15)	(20)	(25)
	C	54	72	90
	D	<u>(35)</u>	<u>47</u>	<u>60</u>
	Subtotal	54	119	195
Año Nuevo	E-F	(25)	(35)	43
	G	300	400	500
	H	(22)	30	35
	I	<u>(15)</u>	<u>(20)</u>	<u>(25)</u>
	Subtotal	300	430	580
	Grand Total	354	549	775

Note: Low estimates assume 25% of structures are economic; most-likely assumes 50%; high assumes 75% of structures are economic.

Source: ERCE and Crouch, Bachman and Associates, 1988.

were arrived at in the same manner as those made for the Bodega Basin. Structure E-F is actually two separate structures; however, because they are close enough to one another to be developed from one central platform, and because taken separately, they are too small to be economically viable targets, we have lumped them together. Of the four structures listed on Table 4-2, we consider only I to be uneconomic in terms of a viable exploration target for the high scenario. Although it has fairly marginal reserves, structure H is included because it can probably be developed from a platform set on adjacent structure G.

Estimated Gas Reserves

Estimates of associated gas were arrived at by applying a range of gas-to-oil ratios from the offshore Santa Maria Basin to the respective oil estimates. Table 4-3 summarizes the estimated recoverable gas reserves for both basins.

Anticipated Oil and Gas Characteristics

The anticipated oil and gas characteristics for Lease Sale 119 basins presented in Table 4-4 are taken from reports on the offshore Santa Maria fields published in the *Oil and Gas Journal* and from oil company development and production plans in the Santa Barbara Channel. As stated earlier, the Santa Maria Basin produces from the Monterey Formation and is considered to be analogous to any production in the Bodega and Año Nuevo basins (CBA 1988).

In general, Monterey crude is characterized as having a high sulfur and metal content and high viscosity or thickness. Monterey petroleum has two to five times as much sulfur as other types of crude oil refined in California, and it contains four to six times as many metals as other crudes.

The specific gravity of an oil is the ratio of the weight of the petroleum product to the weight of an equal volume of water. The American Petroleum Institute (API) gravity is often used to describe crude oil in degrees, ranging from a light crude rating of 40 API to a heavy viscous crude with a rating of 14 API. A lower API gravity means there is a higher gas/oil and residual content.

Table 4-3

**ECONOMICALLY RECOVERABLE GAS RESERVE ESTIMATES
FOR CENTRAL CALIFORNIA OCS**

<u>Basin</u>	<u>Structures</u>	<u>Estimated Gas Reserves (in billion cubic feet)</u>		
		<u>Low</u>	<u>Most Likely</u>	<u>High</u>
Bodega	A	0	0	27
	B	0	0	-
	C	11	25	54
	D	<u>0</u>	<u>17</u>	<u>36</u>
	Subtotal	11	42	117
Año Nuevo	E-F	0	0	27
	G	60	140	300
	H	0	10	21
	I	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	60	150	348
Grand Total		71	192	465

Note: Low estimate assumes a gas-oil ratio (GOR) of 200 cu. ft./bbl.; most-likely assumes a GOR of 350 cu. ft./bbl., and high assumes a GOR of 600 cu. ft./bbl.

Source: CBA 1988

Table 4-4
ANTICIPATED OIL AND GAS CHARACTERISTICS

Oil type:	Monterey, generally low API gravity and high sulfur content.
API Gravity:	Range = 8-25 degree; average = 18 degree
Sulfur:	Range = 2.7%: average = 5%
Heavy Metals (in ppms):	Va (200-350); Ni (100-150); Fe (10-18)
Acidity:	Unknown
Paraffin Content:	10-20%
Gas Type:	Approximately 82 to 89% methane
Hydrogen Sulfide:	15,000-20,000 ppmv ^a (parts per million by volume)
Gross Heating Value:	1100 Btu/cu.ft.

a. The Chevron Point Arguello project development drill tests show H₂S levels in the gas at higher levels than originally anticipated.

Source: CBA 1988.

The viscosity measures the resistance of a fluid to flow. A highly viscous fluid will resist movement through a pipeline. The thickness of crude oil can be reduced by heating or diluting it with lighter petroleum products.

Sulfur content of crude includes both sulfur as a compound, such as sulfide, and hydrogen sulfide (H₂S) gas. These both have an impact on transporting and processing crude because the sulfur compounds must be reduced to a certain level before the crude is transported and refined. When crude oil contains a high level (.05 cubic feet of H₂S per 1000 gallons) it is classified as sour. Sweet crude oil has a lower level of sulfur.

4.5 MMS RESERVE AND DEVELOPMENT ESTIMATES

The MMS normally presents detailed estimates of recoverable reserves and corresponding development (platforms) in their Draft EIS for the lease sale. Because the Draft EIS for Lease Sale 119 has not been released, the only estimates we have for comparison are the MMS's somewhat generalized, interim resource and development estimates presented in the proposed five-year plan entitled, Final Environmental Impact Statement: Proposed Five-Year Outer Continental Shelf Oil and Gas Leasing Program Mid-1992 (MMS 1987f). In this regard, the reader should bear in mind that the MMS's reserve and development estimates, which are due to be released with their Draft EIS for Lease Sale 119, will undoubtedly be different from those presented in their proposed five-year plan. Past experience suggests that the MMS's Draft EIS reserve and development estimates for Lease Sale 119 will probably be substantially higher than those presented in the proposed five-year plan.

The MMS's most currently available estimates of reserves and corresponding development for central California, which were presented in the proposed five-year plan, are listed on Table 4-5 . The low case reserves and the individual basin estimates are not listed on Table 4-5 because these figures were not given in the proposed five-year plan. Instead, the MMS listed only the base (mean) and high case estimates for the entire Lease Sale 119 area being considered under the proposed five-year plan. It should also be noted that the MMS's estimates include reserves within the proposed deferred area of Lease Sale 119 that are in water depths greater than 3000 feet (Alternative II in the proposed five-year plan). However, as indicated in the proposed five-year plan, eliminating the reserves from this area proposed for deferral does not change the MMS's estimated number of development

Table 4-5
MMS OIL AND GAS RESERVES AND PLATFORM ESTIMATES
FOR OCS LEASE SALE 119

<u>Basin</u>	<u>Oil (in Million Barrels)</u>	<u>Gas (Tcf)</u>	<u>Number of Production Platforms</u>
<i>Low Case</i>			
Bodega + Año Nuevo	not given	not given	not given
<i>Mean Case</i>			
Bodega + Año Nuevo	153	286	1
<i>High Case</i>			
Bodega + Año Nuevo	300	560	2

Source: MMS 1987a, Proposed Final Five-Year Oil and Gas Leasing Program.

platforms and it only slightly decreases reserve estimates (from 153 million barrels to 144 million barrels of oil for the base case).

The MMS's estimates are conditional estimates (i.e., they assume that economically recoverable hydrocarbons are present). The resource estimation process used by the MMS incorporates a computer program called PRESTO (Probabilistic Resource Estimates, Offshore). Estimates include both prospects (individual structures) identified through interpretation of geological and geophysical data and prospects postulated by the extrapolation of geologic trends into areas having scant data.

The PRESTO model incorporates a number of variables that are critical to the amount of resources determined. The variables used to define prospects and their resource potential are:

1. Areal extent of prospect (acres).
2. Pay zone and thickness (feet).
3. Oil recovery factor (barrels/acre-feet).
4. Gas recovery factor (thousand cubic feet/acre-feet).
5. Proportion of the zone pay thickness consisting of gas.
6. Solution gas-to-oil ratio (cubic feet/barrel).
7. Condensate yield (barrels/million cubic feet of gas).

In chiefly frontier areas, such as Lease Sale 119, many of these variables are not well known. Hence, estimates by this method are generally "ball park" estimates at best. Recognizing the inherent uncertainty associated with these estimates, the MMS has included two potential outcome scenarios: (a) base case, and (b) high case. The base case includes an estimate of the resources assumed to be leased, developed, and produced, given that hydrocarbons exist in the area (i.e., a conditional estimate), and an estimate of the exploration, development, production, and transportation activities appropriate to that level of resources. The high case is an estimate of a significantly higher level of resource recovery and attendant exploration and development activity which could result from higher leasing interest than estimated for the base case, or which could result from discoveries of larger oil and gas accumulation than estimated under the base case assumptions.

In summary, it is impossible to evaluate, in detail, the MMS's estimates because we do not know; (a) what kind of analog (another basin of similar type) they used; (b) what numbers

they used in the computer program; (c) how much actual geologic knowledge they applied to the computer model of basins; and (d) how much detail they applied (i.e., whether they took into account individual structures or simply extrapolated trends).

4.6 COMPARISON OF MMS AND ERCE RESERVE ESTIMATES

In the proposed five-year plan, the MMS doesn't specify exactly which variable they used to arrive at their reserve and development estimates. Nor, as pointed out previously, do they list reserves and development platforms for each basin or for a low case scenario. Thus, all we can really compare is the MMS's estimated base case and high case totals for the Lease Sale 119 area with ERCE's combined mean and high case totals for the Bodega and Año Nuevo basins. These totals, along with ERCE's low case estimates and individual basin estimates, are listed on Table 4-6.

It is interesting to note that ERCE's low case oil reserve total for the Bodega and Año Nuevo basins exceeds the MMS's high case oil reserve estimate for Lease Sale 119. Also noteworthy is the comparison of estimates for recoverable gas reserves: the MMS estimates a Gas-Oil Ratio (GOR) of almost two times, whereas ERCE's GOR estimates are generally less than one-half times. At this time we believe that ERCE's estimates are far more realistic because they reflect well-established test and production parameters from the offshore Santa Maria Basin.

It should again be reiterated that, although the MMS's and ERCE's reserve estimates listed on Table 4-6 are vastly different, we suspect that the MMS's soon to be released Draft EIS reserve estimates for Lease Sale 119 will be much higher and probably much closer to ERCE's

Table 4-6

**COMPARISON OF MMS AND ERCE ESTIMATED
RECOVERABLE RESERVES FOR LEASE SALE 119**

	MMS ^a Estimates		ERCE ^b Estimates	
	Oil	Gas	Oil	Gas
	(Million bbls)	(Bcf) ^c	(Million bbls)	(Bcf)
<i>Low Case</i>				
Bodega	not given	not given	54	11
Año Nuevo	<u>not given</u>	<u>not given</u>	<u>300</u>	<u>60</u>
Total	not given	not given	354	71
<i>Mean Case</i>				
Bodega	not given	not given	119	42
Año Nuevo	<u>not given</u>	<u>not given</u>	<u>430</u>	<u>150</u>
Total	153	286	549	192
<i>High Case</i>				
Bodega	not given	not given	195	117
Año Nuevo	<u>not given</u>	<u>not given</u>	<u>580</u>	<u>348</u>
Total	300	560	775	465

a. Source: Minerals Management Service 1987g.

b. Source: CBA 1988.

c. Bcf = billion cubic feet of gas



CHAPTER 5

CHAPTER 5

OFFSHORE OIL DEVELOPMENT SCENARIOS FOR CENTRAL CALIFORNIA

5.1 OVERVIEW

This chapter is intended to answer the following questions: If Lease Sale 119 were to take place, how much offshore oil development would take place? How many platforms would be built? Where would the oil be processed? How would it be transported out of the area? These questions and others are addressed in this chapter as plausible scenarios are outlined for Lease Sale 119. In order to show a range of development activities, ERCE examined two scenarios: a most-likely or "base-case" scenario and a "high-case" scenario. The decisions analysis process that was used to develop each scenario was based on a set of assumptions concerning oil exploration and development activities. The decisions analysis process and assumptions used are discussed below.

5.2 DECISIONS ANALYSIS

The process of deciding whether to explore and develop offshore oil resources is a difficult exercise and is one which the oil industry undertakes with caution and much research. In general terms, the principle factors which influence an oil company's decision to proceed with an offshore project are:

- Known, economically recoverable oil and gas reserves;
- Engineering and siting requirements;
- Cost and economic feasibility; and
- Environmental and regulatory constraints.

Offshore oil development scenarios must first be based on information of known oil and gas reserves which can be economically recovered. In Chapter 4 (Oil and Gas Estimates for Central California OCS) estimates of potential reserves, their locations, and potentially developable lease tracts in the study area are identified. In this special study for this report, Crouch, Bachman, and Associates developed low, mean, and high estimates for successfully recovering oil and gas reserves from the Bodega Basin and the Año Nuevo

Basin (see Chapter 4, Tables 4-1 and 4-2). Having this information allows us to proceed with the decisions analysis process for oil development scenarios.

Figure 5-1, Decisions Analysis Process for Offshore Oil Development Projects, outlines the steps used to develop offshore oil scenarios for this Regional Studies Program. The first three steps (boxes) address the resource estimate assumptions noted above. The next steps, which follow along the top three lines in Figure 5-1, address the location, number and size of platforms, pipelines, onshore processing facilities, and marine terminals that would be required to develop the reserves. The fourth line addresses basic assumptions regarding the type and quality of oil and gas which in turn dictates the type of processing and refining. The fifth line of the analysis chart represents decisions regarding oil company consortiums or partnerships in developing adjacent oil lease tracts and consolidation of onshore processing, transportation, and support facilities.

Noticeably absent from the decisions analysis process is a consideration of economic feasibility and environmental and regulatory constraints. Both subjects are very important in determining whether oil can or will be developed off of central California, but virtually no information was available for this study regarding either of these subjects. For example, economic feasibility is determined solely by the oil industry based on lease sale costs, current oil prices, proposed project costs, and environmental review and mitigation costs. Oil development costs and expected returns on investment are also considered to be confidential information by the oil industry. The following development scenarios are based on the assumption that development is not prohibited by environmental or regulatory restrictions. Five of the six central coast counties have passed initiatives which restrict onshore facilities related to offshore development (see Appendix B). Certainly these and other similar measures could prevent or severely limit oil development activities. However, it is important to note that the purpose of this chapter is not to determine the "feasibility" or likelihood of offshore oil development, but to look at the amount of offshore oil development that could take place and the related impacts. Outlined below are the assumptions used to build the oil development scenarios for Lease Sale 119.

5.3 SCENARIO DEVELOPMENT ASSUMPTIONS

The relevant planning assumptions used by the Regional Studies Program to build the offshore development scenarios for Lease Sale 119 are listed in Table 5-1.

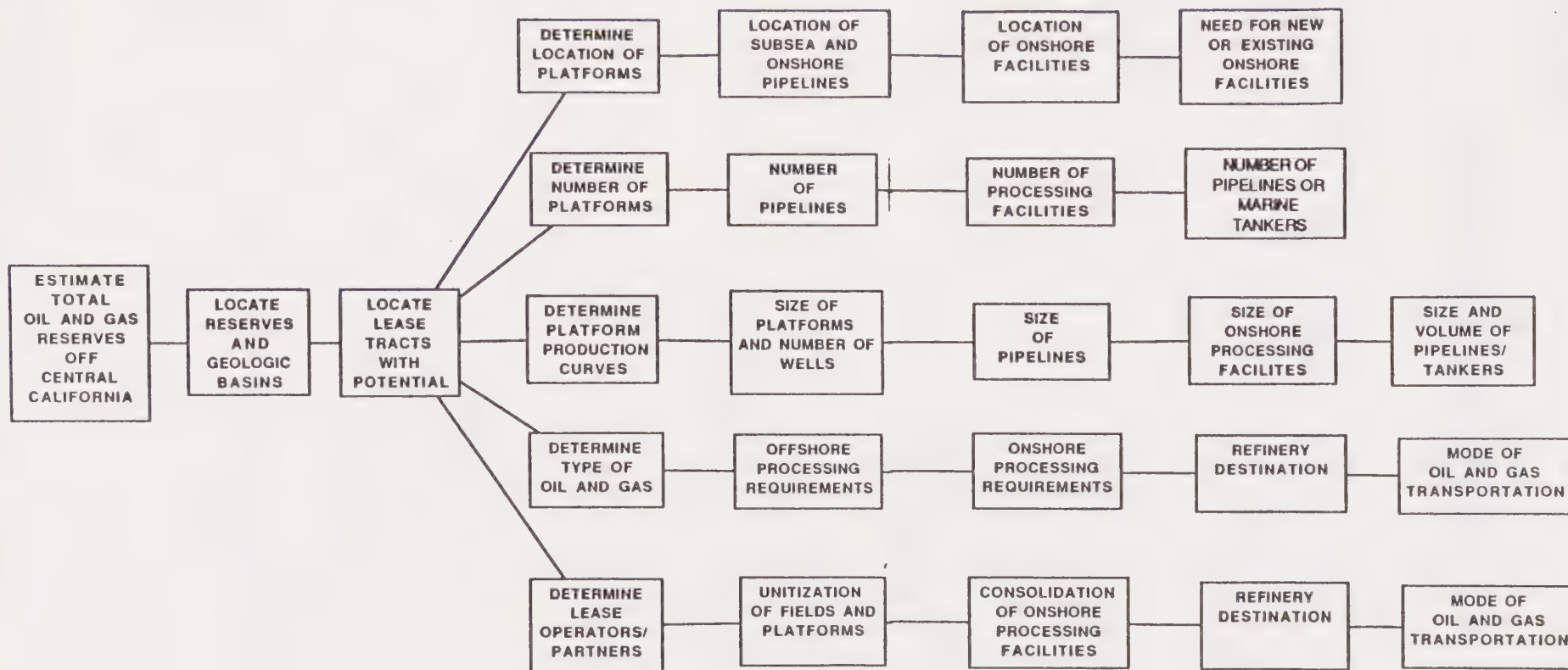


Table 5-1

**SCENARIO DEVELOPMENT ASSUMPTIONS
FOR LEASE SALE 119**

Lease Sale Schedule	Lease Sale 119 for central California will take place in March 1991 as scheduled. A cancellation or significant delay in this lease sale schedule would change many of the subsequent scenario assumptions.
Lease Sale Offering	Approximately 327 OCS lease tracts may be offered by the MMS (MMS 1987).
Oil and Gas Reserves	Nine geologic structures were identified in this study area as having a high potential for recoverable oil and gas reserves. Their locations are shown in Chapter 4, Figure 4-1 and are labeled A through I.
Lease Tracts Acquired	Approximately 24 (base-case) to 34 (high-case) tracts would be leased by the oil industry in Lease Sale 119. These numbers correspond roughly to the tracts covering the nine geologic basins noted above.
Exploration Drilling	All 24 to 34 tracts offshore central California would be explored by industry within 5 years after the lease sale. A typical exploration rig will drill an average of 3 to 4 wells per tract over a period of 60 to 90 days. Depth of each well is between 8,000 and 12,000 feet below sea level. The cumulative effect of this activity would result in approximately 4 to 10 exploration rigs drilling off the central California coast at the same time.
Exploration Support Activities	Exploration drilling generates significant supply and crew boat and helicopter traffic. While the oil industry may attempt to use existing ports, harbors, and airports to support this exploration drilling, building new support facilities along the central coast is a possibility.

Table 5-1 (Continued)
SCENARIO DEVELOPMENT ASSUMPTIONS
FOR LEASE SALE 119

Platform Locations	Platforms are sited on the tracts which are known to have economically recoverable oil and gas reserves. It is assumed in this study that individual tracts having more than 30 million barrels of oil reserves would be developed from an individual platform.
Platform Size/Numbers	One platform, with an average of 50 wells, would be required for every 30 (minimum) to 150 (maximum) million barrels of oil discovered.
Platforms per Lease	Only one platform per lease tract would be required to develop the underlying oil and gas resources.
Development Prospects	It is assumed in this study that the development of structures A, C, and D in the Bodega Basin and structures E, F, and G-H in the Año Nuevo Basin would be prospects with a high probability for oil and gas reserves. Structures B and I are assumed to be uneconomical and would not be developed under either scenario.
Development Platforms	Development of the structures noted above would require between 5 (base-case) and 8 (high-case) platforms. Development and Production Plans (DPP) would be filed to MMS for each platform project. The proposed platforms on structure G are close enough together to be considered in one unit and therefore only one DPP may be prepared for that project. An EIS would be prepared for each DPP. The process of reviewing and approving each platform by federal, state, and local agencies could take up to 5 years.

Table 5-1 (Continued)
SCENARIO DEVELOPMENT ASSUMPTIONS
FOR LEASE SALE 119

Consolidation	Consolidation of facilities is where several oil companies will agree to use one single facility for oil and gas processing, pipeline transportation or marine terminals. Consolidation is not preferred by industry and is only an alternative after it is required by local or state policy. For this "worst-case" scenario, it is assumed that processing facilities would not be consolidated and that each platform (or platform unit) would require its own individual onshore processing facility.
Onshore Pipeline Transportation	The use of onshore pipelines is one option for transporting oil and gas out of the counties to refinery destinations. Separate oil and gas pipelines would be required from each onshore processing facility.
Marine Terminals	Marine terminals are an alternative to onshore pipeline transportation of crude oil. It is assumed in this study that marine terminals would be consolidated and that only one terminal would be built within each basin.
Refinery Destinations	It is assumed in this study that a majority of central California OCS crude oil would be transported to San Francisco Bay area refineries. Some oil may be transported to other refineries in California or to the Gulf Coast. Refinery destination will be dictated by oil ownership and the location of that company's refineries.

Table 5-1 (Continued)
SCENARIO DEVELOPMENT ASSUMPTIONS
FOR LEASE SALE 119

Development Wells	Approximately 5 years after a DPP is filed, development drilling would begin. It is assumed that each platform would drill a total of 50 wells. Each development well can take 45 to 52 days to complete.
Oil and Gas Production	Each platform produces oil and gas for approximately 15 to 20 years and 50 percent of each reserve is produced in the first 5 years of development drilling, with a peak in the fifth year. Production decreases by about 15 percent each year thereafter.
Platform Pipelines	Subsea pipelines would be required for transporting oil and gas from a platform to an onshore processing facility. Additional subsea pipelines for water and power connection would also be required.
Oil Processing Facilities	Oil processing can take place at either of two locations: 1) at an onshore oil processing facility, or 2) at an offshore storage and treatment (OS&T) vessel. The size of the processing facility is dictated by the amount of oil production from the platform. Onshore oil processing facilities are usually located within the county which is closest to the offshore field. Facility sites are typically located by the oil industry in the coastal zone, which minimizes the distance between the platform and the facility. OS&T vessels are located adjacent (within 5000 feet) to a platform.
Gas Processing Facilities	Gas processing will occur onshore. Gas processing facilities are also typically located in coastal sites.

5.4 LEASE SALE 119 ACTIVITY

It is not certain what level of interest Lease Sale 119 may generate from the oil industry, considering the current price of oil and the controversy surrounding the lease sale and offshore oil impacts. Other factors which will influence the lease tract bids by the oil industry are geophysical survey results and resource estimates (which are conducted prior to the lease sale), forecasted prices of oil, the location of the tracts (depth of water, sea conditions), the cost of producing and transporting from that location, and the environmental sensitivities and permitting constraints of developing the offshore and onshore facilities.

Lease Sale 119 activity can also be forecasted by looking at past lease sale activity. A review of the last five lease sales off California (OCS Lease Sales 48, 53, 68, 73, and 80) show that while a significant amount of acreage (tracts) was initially offered, a relatively small number of leases were actually bid on and awarded at each sale as shown below.

<u>OCS Lease Sale</u>	<u>Tracts Offered</u>	<u>Leases Awarded</u>
#80	657	23
#73	137	8
#68	140	29
#53	111	60
#48	148	54
(Upcoming) #119	327	(Assumed) 34

According to the latest MMS plans (1987) approximately 327 lease tracts may be offered for Lease Sale 119. For this lease sale area the probable location and volumes of from 5 to 7 hydrocarbon resources have been estimated in Section 4.4 of this report. The number of leases covering the nine known geologic structures (A through I) range between 24 and 34 tracts, depending on how one interprets the preciseness of the structure boundaries and the platform coverage required to develop each structure. These lease tract numbers will be used in designing the exploration and development scenarios described below.

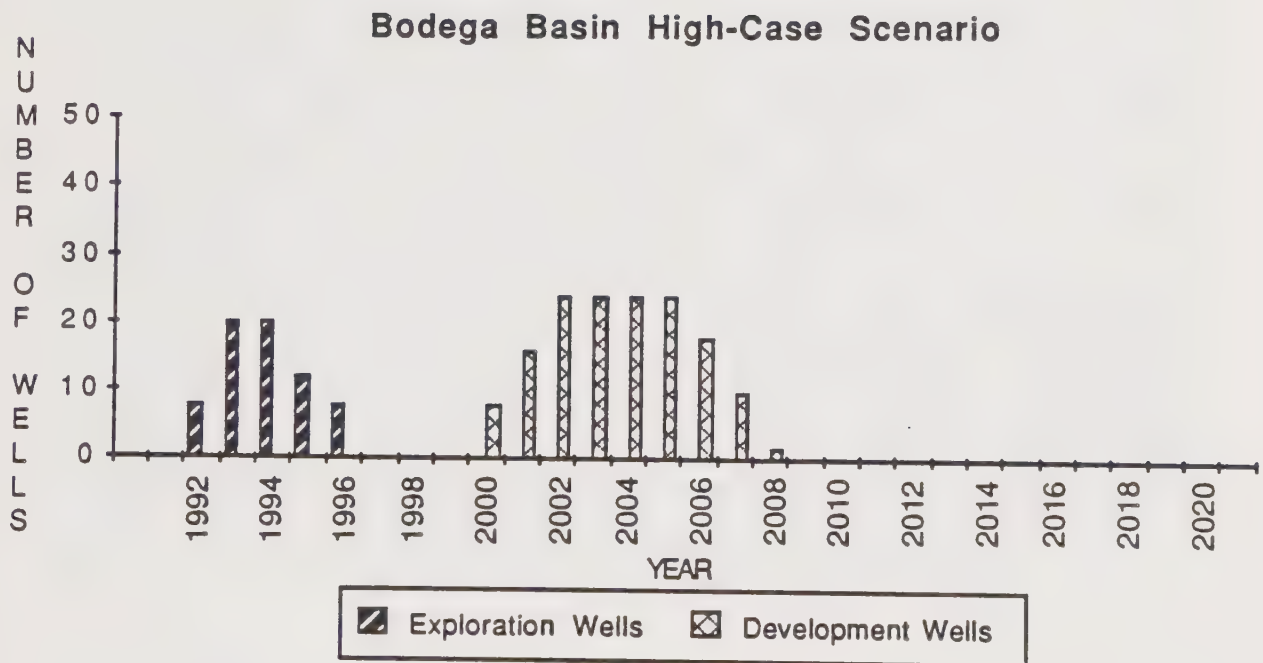
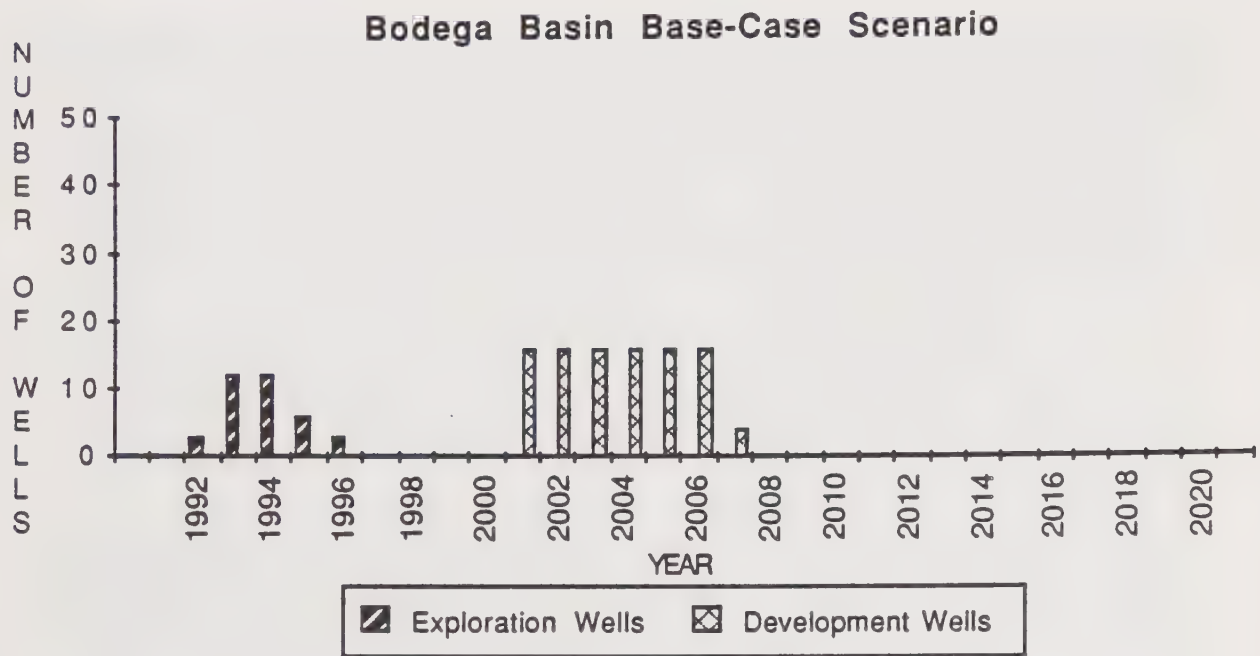
5.5 EXPLORATION SCENARIOS

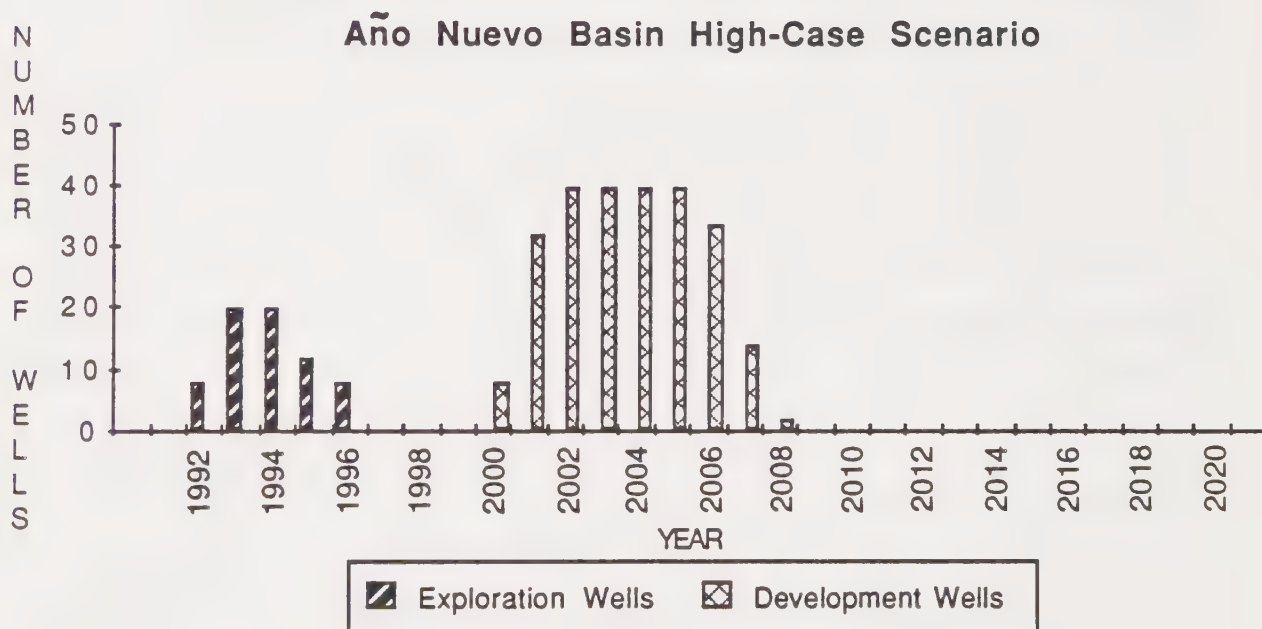
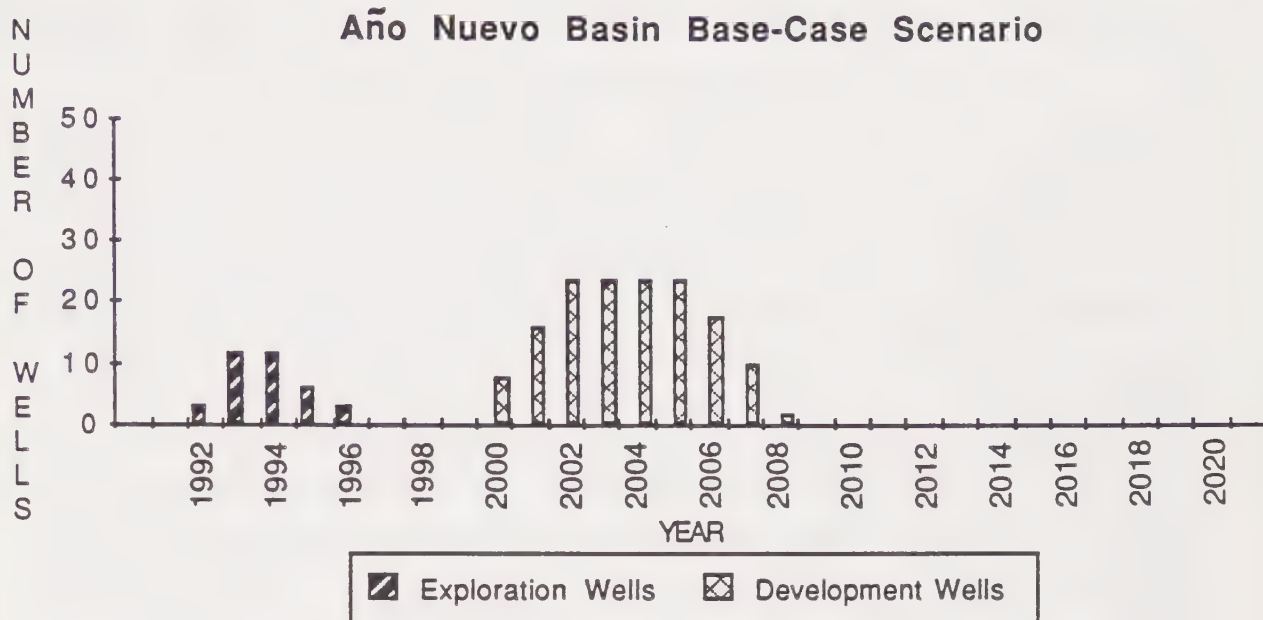
Within 5 years following the lease sale, the oil industry must file Plans of Exploration (POE) for all lease tracts acquired. This assumption is based on the premises that

(1) following the lease sale, all companies would pursue their investments by exploring for oil, and (2) the MMS requires that POEs be filed for all leases within 5 years or the lessee faces the possibility of losing (or quitclaiming) the lease. Assuming a March 1991 lease sale date, the POEs would be submitted throughout the 1991 to 1996 timeframe. Review and approval of each POE by the MMS and consistency approval by the CCC can take between 9 and 12 months.

Following approval of the POE, the lease tract would be explored for oil and gas using an exploration rig. If all 34 tracts are explored within this 5-year timeframe, as many as 10 rigs could be operating at the same time offshore central California. (During 1984 as many as 13 rigs were working in offshore southern California.) Total number of exploration wells drilled (an average of 3 to 4 wells per lease multiplied by number of leases) in both basins would be 72 wells under the base-case scenario and 136 wells under the high-case scenario. This exploration drilling activity would take place between 1992 and 1996 as is shown in Figures 5-2 and 5-3.

Exploration drilling is short term and temporary when it pertains to a single lease, but would result in long-term, cumulative activities when considering the total number of leases and wells to be drilled in the same region within a limited timeframe. A significant amount of supply and crew boat and helicopter services will be required to support the 5 years of exploration drilling. (See Chapter 3 for a description of supply and crew bases.) If exploration drilling were to occur in the Bodega or Año Nuevo basins, supply base services would be needed for delivery of pipe, drilling equipment, drill muds, chemicals, food, water, and personnel. Currently, supply and crew base support services do not exist in central California, however, some industrial ports in San Francisco Bay could accommodate some of these services. New supply and crew base sites may need to be built along the central Coast. Existing ports and harbors are prime candidates for supply and crew bases and it is quite possible that the counties in both the Bodega and Año Nuevo basin study areas would receive proposals for new supply and crew base projects. (See Chapter 6 for a discussion of existing ports and harbors.)





5.6 DEVELOPMENT/PRODUCTION SCENARIOS

Development and Production Plans

This report identifies a total of nine geologic structures (A through I) in the two basins. These structures are covered by up to 34 lease tracts. Following exploration and testing, the oil industry will begin the process of evaluating the potential fields in Bodega and Año Nuevo basins. It is realistic to assume that a number of leases explored would result in "dry holes" or in uneconomical or unrecoverable finds. In this report's resource estimates, it was assumed that 25 percent (low estimate), 50 percent (mean), and 75 percent (high) of the structures explored would result in recoverable reserves (see Chapter 4, Table 4-2). Based on this set of assumptions, structures A, C, and D in the Bodega Basin would be development prospects. In the Año Nuevo Basin, structures E, F, and G-H would also be development prospects. Structure B in the Bodega Basin and structure I in the Año Nuevo Basin are assumed to be uneconomical and would not be developed under either scenario.

For each platform or group of platforms proposed, a Development and Production Plan (DPP) would be submitted to the MMS by the oil company holding the lease tract. Because the platforms on structure G would be close together, it is plausible that only one DPP would be submitted for the entire structure. If onshore or state tidelands oil facilities are required for a development project (i.e., an onshore processing facility and pipelines), the applicant will also have to prepare and submit Development Plan (DP) applications to the State Lands Commission and the local county planning department. All the central coast counties, except Marin, have passed local oil initiatives, which require voter approval of onshore facilities related to offshore development (see Appendix B). Therefore, applicants for onshore facilities must comply with the applicable local oil initiative before they can obtain a local permit.

Once the DPP applications have been completed, the MMS together with the State Lands Commission and the county will prepare a joint EIS/EIR (known as EIS/R) under NEPA and CEQA. Once the EIS/R is certified, there are an array of other agency permits and final development plan conditions which must be approved. The overall review and approval process for an individual development project would take between 5 and 6 years before an oil company can obtain the right to install a platform and break ground for onshore facilities. Assuming DPP platform applications are submitted for each development

prospect, some federal, state, and county agencies would be faced with a total of 10 years of intensive oil and gas planning and permitting activities.

In order to estimate the level of development in Bodega and Año Nuevo basins, ERCE used comparative data from similar Santa Maria Basin development projects in offshore Santa Barbara County. There are currently three major oil fields in the Santa Maria Basin: the Point Pedernales (Unocal), Point Arguello (Chevron and Texaco), and San Miguel (Shell) fields, each of which will be producing oil and associated gas from the Miocene Monterey Formation. The estimated oil reserves and platforms planned for the three fields are as follows: Point Pedernales - 80 million barrels with one platform; Point Arguello - 300 to 500 million barrels with three platforms (one or two additional platforms may be added in the future); and San Miguel - 100 million barrels with one platform. Unocal originally planned to develop the Point Pedernales field with two platforms, but due to the current economic situation, a second platform is not planned in the foreseeable future (Personal communication, Darwin Sainz, Unocal 1989). Unocal anticipates that the majority of the field can be produced from one platform. Unocal's Platform Irene has 72 well slots, however they estimate that a total of only 25 wells will actually be drilled (Personal communication, Darwin Sainz, Unocal 1989). The number of well slots on these platforms vary from 48 to 76 and the average is about 58. The estimated drainage area or drilling well "reach" for these platforms is about 8,000 to 12,000 feet below sea level.

Based on similar development and geologic information for the Bodega and Año Nuevo basins, it is assumed that one platform with 50 development wells would be required for each structure having between 30 to 150 million barrels of oil reserves. These figures were used, along with an 8000 foot well reach, to estimate the location and number of platforms required to develop the reserves in the Bodega and Año Nuevo basins.

Bodega Basin Platforms

Table 5-2 outlines the base-case scenario for the Bodega Basin. Under this scenario the basin has economically recoverable reserves of 119 MMBBLS of oil and 42 billion cubic feet (Bcf) of gas from structures C and D. It is assumed that two platforms would be required, one each on structures C and D.

Table 5-2

BASE-CASE SCENARIO FOR CENTRAL CALIFORNIA OCS

Scenario Assumptions	Bodega Structures					Año Nuevo Structures					Total
	A	B	C	D	Subtotal	E-F	G	H	I	Subtotal	
Potential Oil Reserves (million barrels)	36	20	72	47	175	35	400	30	20	485	660
Economically Recoverable Reserves	0	0	72	47	119	0	400	30	0	430	549
Platforms	0	0	1	1	2	0	2	1	0	3	5
Peak Production (thousand barrels per day)	0	0	34	23	57	0	173	12	0	185	242
Processing Options											
Onshore Processing Facilities	0	0	1	1	2	0	1	0	0	1	3
Offshore (OS&T) Processing	0	0	1	1	2	0	1	0	0	1	3
Transportation Options											
Onshore Oil Pipelines to Refineries	0	0	1	1	2	0	1	0	0	1	3
Onshore Gas Pipelines	0	0	1	1	2	0	1	0	0	1	3
OS&T Marine Terminals	0	0	1	1	2	0	1	0	0	1	3
Tanker Trips (visits during peak year)	0	0	40	27	67	0	223	0	0	223	290
Onshore Marine Terminals	0	0	1	0	1	0	1	0	0	1	2
Tanker Trips (visits during peak year)	0	0	67	0	67	0	223	0	0	223	290

Table 5-3 outlines the high-case scenario. Here it has been estimated that 195 MMBBLS of oil and 117 Bcf of gas are recoverable from the Bodega Basin, requiring three platforms, one each on structures A, C, and D. The number of estimated platforms and the likely placement of these platforms in the offshore Bodega Basin are shown on Figures 5-4 and 5-5.

Año Nuevo Basin Platforms

According to the estimates in this report, the Año Nuevo Basin contains about three times the volume of recoverable reserves determined for the Bodega Basin. Hence, one might guess that it would require three times the number of platforms for development. However, because the structures in the Bodega Basin are relatively small and isolated, each Bodega Basin structure requires its own platform, whereas the structures in the Año Nuevo Basin are larger and closer together. Also, structure G contains over 80 percent of the estimated recoverable reserves. Therefore, the concentrated reserves in the Año Nuevo Basin can be developed using fewer platforms than the scattered reserves in the Bodega Basin.

Under the base-case scenario for the Año Nuevo Basin (see Table 5-2), estimates of 430 MMBBLS of oil and 150 Bcf of gas from structure G would require a total of three platforms on this one structure. No other structures are considered economical in this case. For the high-case scenario (see Table 5-3), which includes 580 MMBBLS of oil and 348 Bcf of gas, it is assumed that five platforms would be required: one overlying structures E and F, and four over structure G, with one of these platforms situated such that it could also develop the estimated reserves from structure H. The number of estimated platforms and the likely placement of these platforms in the Año Nuevo basin are shown on Figures 5-4 and 5-5.

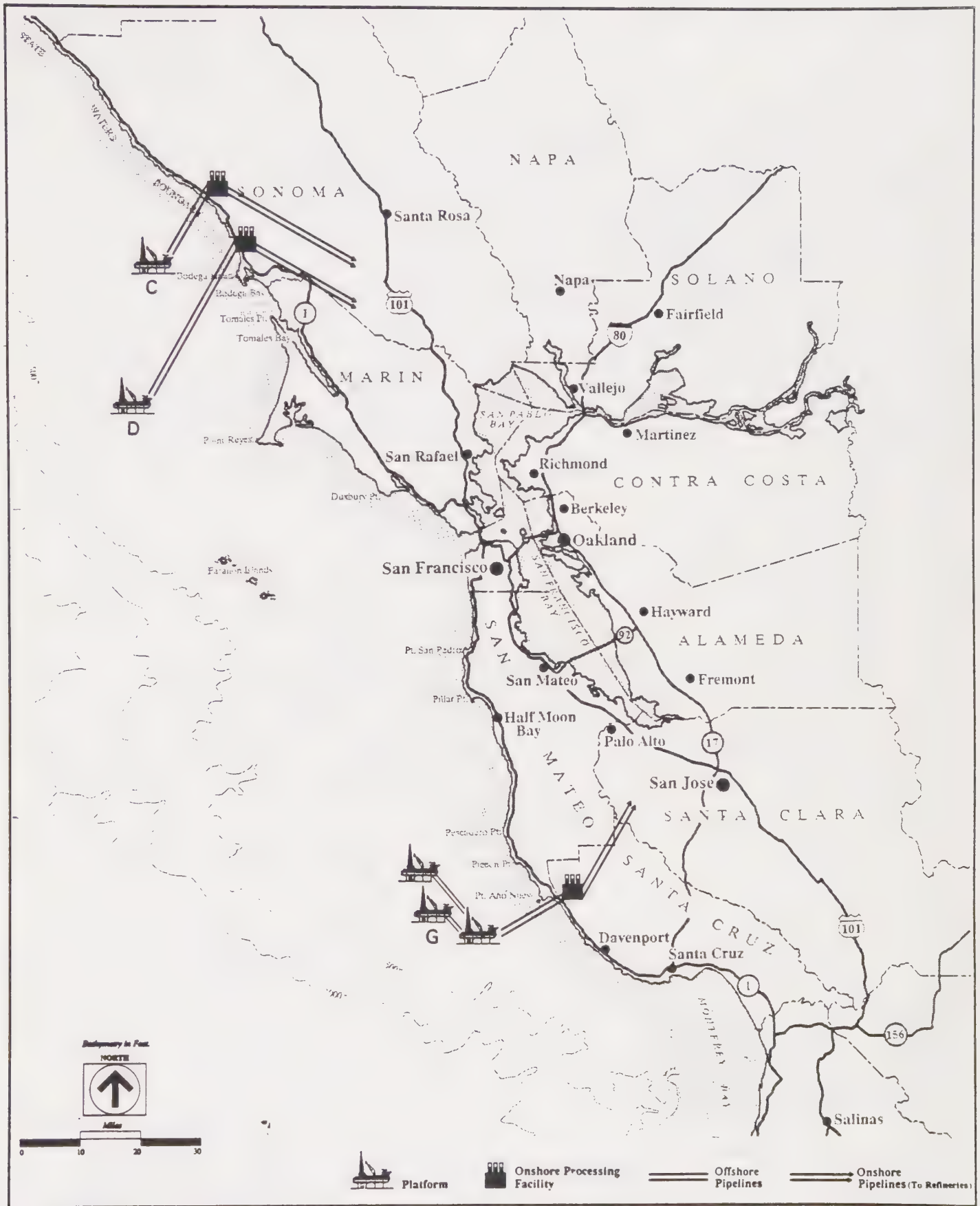
Development Drilling

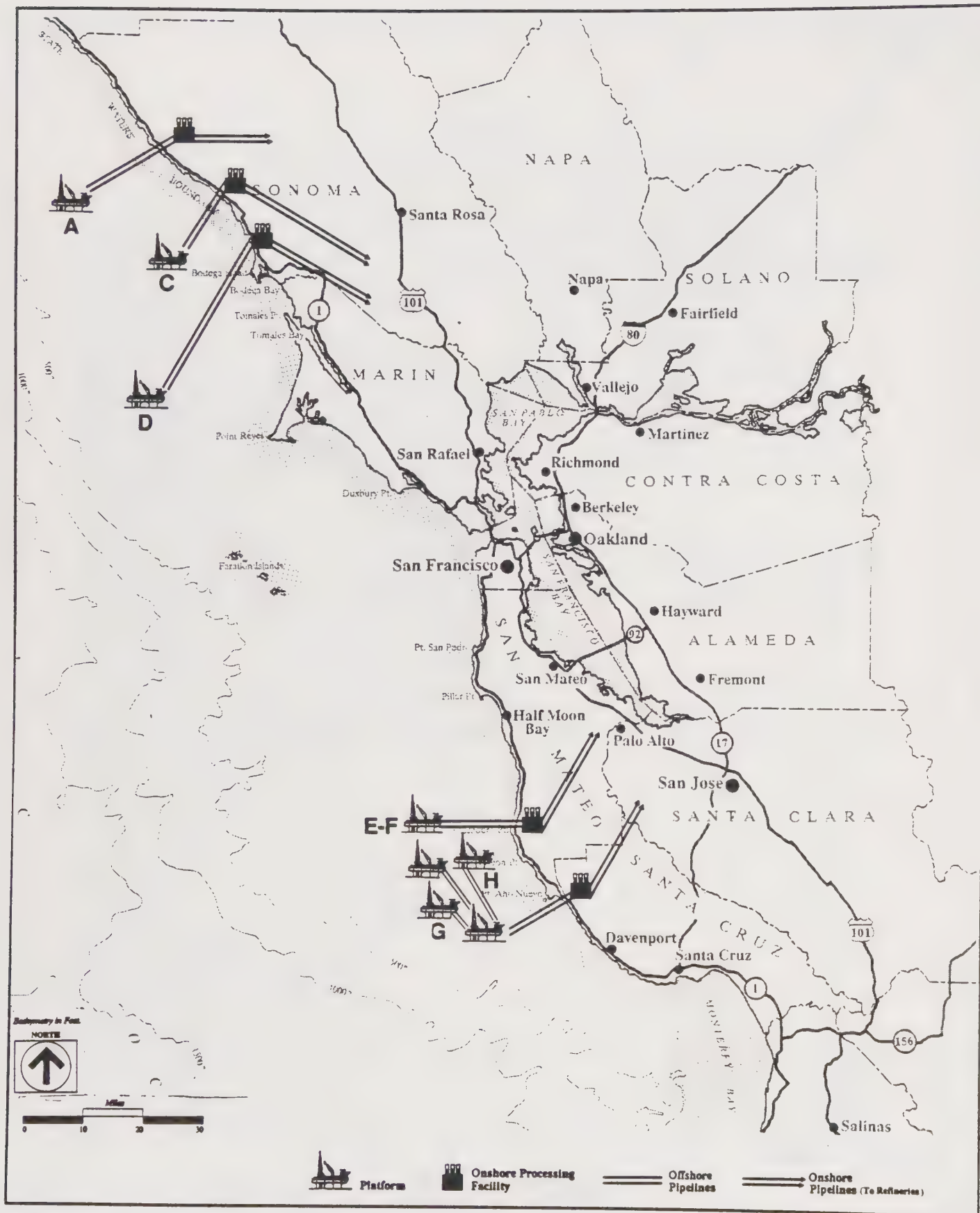
Development well drilling would begin after platform installation is complete. Under the high-case, the total number of wells drilled in the Bodega Basin would be 150 wells, and the Año Nuevo Basin would require about 250 wells (50 wells per platform multiplied by the number of platforms). Figures 5-2 and 5-3 illustrate the estimated exploratory and development drilling schedules for the base- and high-case scenarios for each basin. These schedules show the peak years for drilling and support activities for each basin.

Table 5-3

HIGH-CASE SCENARIO FOR CENTRAL CALIFORNIA OCS

Scenario Assumptions	Bodega Structures					Año Nuevo Structures					Total
	A	B	C	D	Subtotal	E - F	G	H	I	Subtotal	
Potential Oil Reserves (million barrels)	45	25	90	60	220	43	500	35	25	603	823
Economically Recoverable Reserves	45	0	90	60	195	43	500	35	0	578	773
Platforms	1	0	1	1	3	1	3	1	0	5	8
Peak Oil Production (thousand barrels per day)	18	0	35	28	81	18	223	17	0	258	339
Processing Options											
Onshore Processing Facilities	1	0	1	1	3	1	1	0	0	2	5
Offshore (OS&T) Processing	1	0	1	1	3	1	1	0	0	2	5
Transportation Options											
Onshore Oil Pipelines to Refineries	1	0	1	1	3	1	1	0	0	2	5
Onshore Gas Pipelines	1	0	1	1	3	1	1	0	0	2	5
OS&T Marine Terminals	1	0	1	1	3	1	1	0	0	2	5
Tanker Trips (visits during peak year)	23	0	43	33	99	23	290	0	0	313	412
Onshore Marine Terminals	0	0	1	0	1	0	1	0	0	1	2
Tanker Trips (visits during peak year)	0	0	99	0	99	0	313	0	0	313	412





Oil and Gas Production

Oil and gas production from the individual platforms will begin as soon as the development wells are completed and a transportation system is in place for moving the oil and gas from the platform to its processing location. Production from each platform is scheduled to last for approximately 15 to 20 years. Oil and gas production from all platforms in the Bodega Basin is projected to reach a peak of approximately 57,000 BPD under the base-case scenario and 82,000 BPD under the high-case scenario (see Figure 5-6). This is a cumulative production rate from structures C and D for the base-case and for structures A, C, and D for the high-case. Peak production from all platforms in the Año Nuevo Basin is projected to reach approximately 185,300 BPD under the base-case and 257,800 BPD under the high-case scenario (see Figure 5-7).

5.7 OIL AND GAS PROCESSING OPTIONS

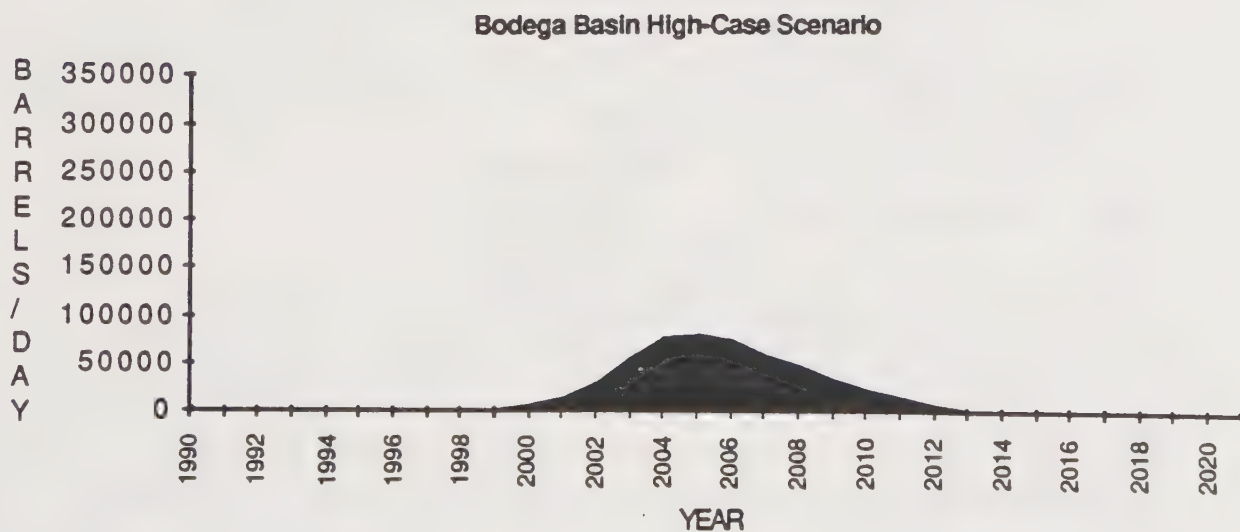
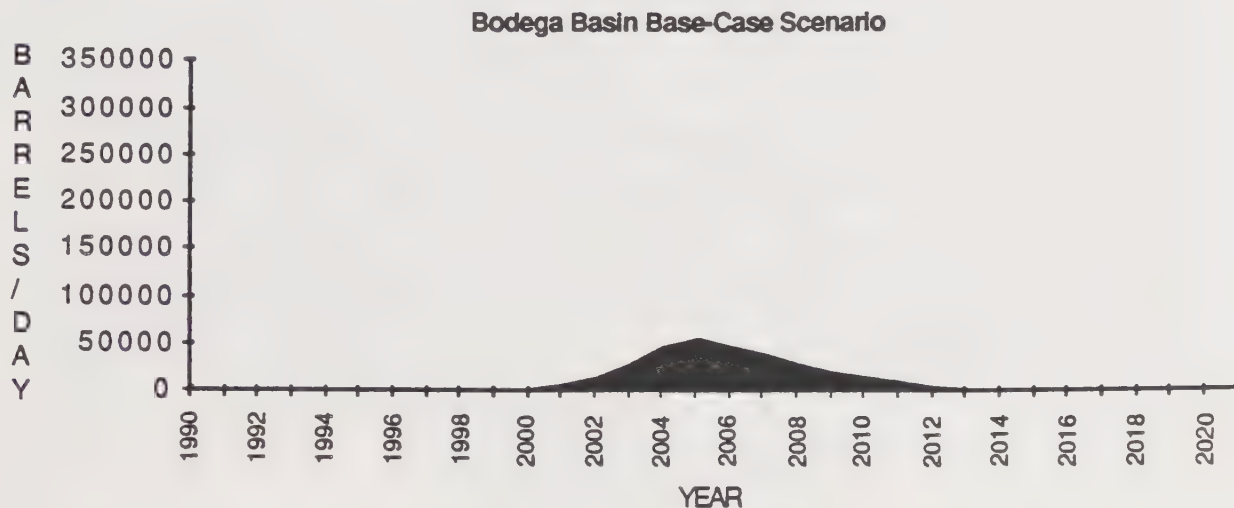
Under these hypothetical scenarios there are two options for processing offshore oil and gas. They are:

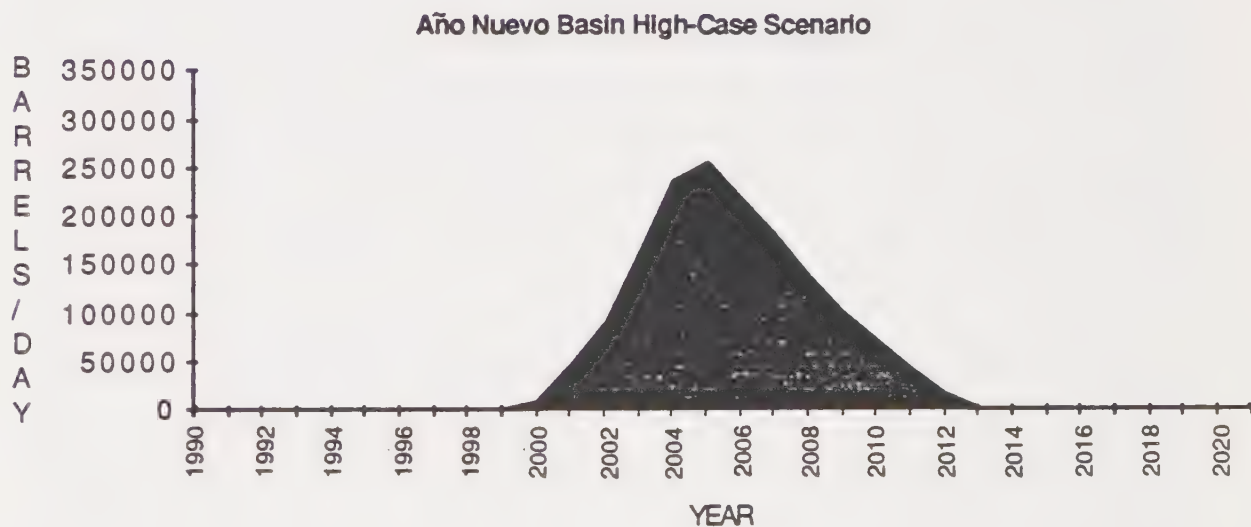
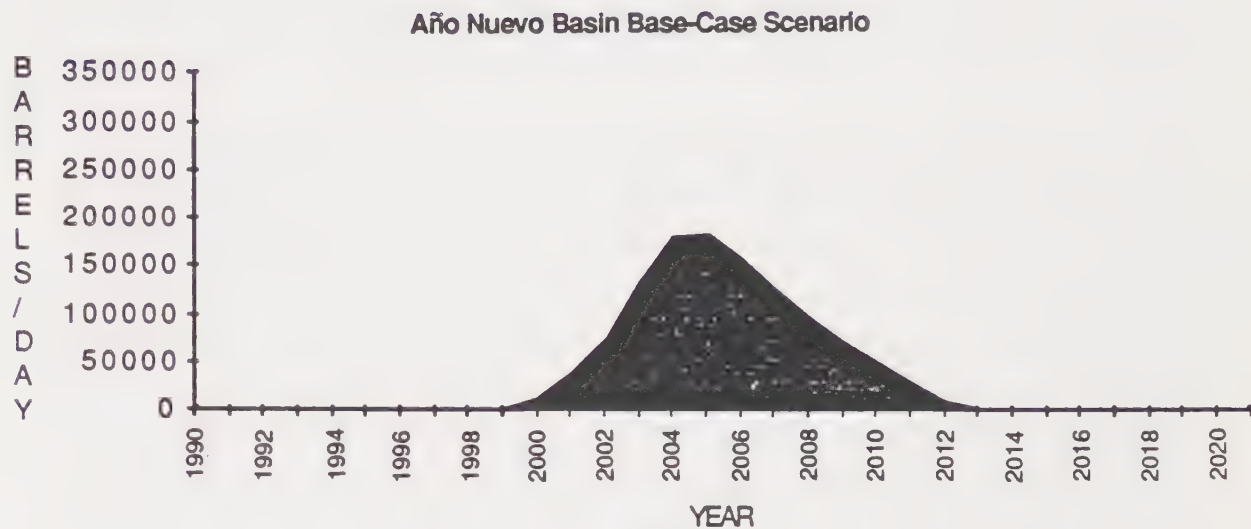
1. Onshore oil and gas processing facilities; or
2. Offshore oil processing via an OS&T, and onshore gas processing.

In the above two options, gas processing will always take place onshore since offshore gas processing is not always feasible or economical.

Onshore Processing Option

Under this option, it is assumed that the three platforms in the Bodega Basin would transport their oil and gas to separate onshore processing facilities. Consolidation of processing facilities at one site for use by the three operators was not an assumption used in this scenario development. The Santa Barbara experience has shown that while "consolidation" of onshore oil and gas facilities makes good planning sense, in reality all the OCS projects permitted to date in the Santa Maria Basin and Santa Barbara Channel are proposing their own onshore processing facilities (e.g., Exxon Los Flores Canyon, Chevron Gaviota, Unocal Lompoc, and Shell San Miguel projects). Therefore, for the Bodega Basin it was assumed that for the base-case scenario there would be two onshore processing facilities (see Figure 5-4). For the high-case there would be three onshore





facilities (see Figure 5-5). Processing capacities at the three onshore facilities from A, C, and D would correspond to the high-case peak production rates of the platforms, which is approximately 18,000 BPD, 35,000 BPD, and 28,000 BPD, respectively (see Table 5-3). Processing facility sites are likely to be located in Sonoma County.

In the Año Nuevo Basin, the central platform from the four-platform unit on structures G-H would pipeline both oil and gas to shore to one large onshore oil and gas facility. In this case, because of the unitization of platforms, it is realistic to assume that only one processing facility would be required for the four platforms. The oil processing capacity of this onshore facility under the high case would be a peak of approximately 223,000 BPD. Gas processing capacity would be about 63 million cubic feet per day. The G-H processing facility would probably be located in Santa Cruz County. Structure E-F would require a second onshore oil and gas processing facility. Processing capacity for E-F would be 18,000 BPD for oil and 4.7 million cubic feet per day for gas. The processing facility for E-F would probably be located in San Mateo County.

Offshore Storage and Treatment Option

As an alternative to onshore oil processing, it is assumed under this option that the platform operators for the Bodega structures A, C, and D would propose individual offshore storage and treatment vessels (OS&Ts) for each of the three platforms. Sharing the use of one OS&T for all the platforms in the basin appears to be infeasible because of the distance between the platforms, which are approximately 20 to 30 miles apart. Processing capacity at each OS&T would be equivalent to the peak capacity of each onshore processing facility as listed above.

The Año Nuevo structures are much closer together which allows for pooling of resources and unitization of platforms. This applies particularly to structures G and H which together may accommodate between 3 and 4 platforms. Unitization of the G-H field would result in three outer platforms being linked to a fourth central platform. Oil and gas from the four platforms would be commingled (measured and then blended) on the central platform. The oil emulsion would be transferred via subsea pipeline from the central platform to one OS&T vessel. Oil processing capacity on the vessel would equal the combined production of the four platforms, which is estimated at 223,000 BPD. The E-F structure is over 10 miles from G and therefore E-F would require a second OS&T vessel.

5.8 OIL AND GAS TRANSPORTATION OPTIONS

There are also three different modes or options of transporting oil from an oil processing facility to a refinery. They are:

1. Oil transport via an onshore pipeline;
2. Oil tanker transport via an OS&T marine terminal system;
3. Oil transport via an onshore marine terminal.

In all cases, natural gas would usually be transported to local distribution centers via an onshore pipeline, since gas processing would most likely take place onshore. Tables 5-2 and 5-3 outline the number of transportation options for each scenario in the Bodega and Año Nuevo basins.

Onshore Pipeline Options

The existing pipeline networks in the central California study area are limited (see Chapter 6). Except for a pipeline transportation network which transports crude from the San Joaquin Valley to the San Francisco Bay area, there are no inter-regional crude oil pipelines in the study area and the only marine terminals capable of handling tankers are in the San Francisco Bay. Therefore, along the central California coast there is no existing hydrocarbon transportation network.

Under this option, crude oil and natural gas would be transported out of the counties via new onshore pipelines. One oil pipeline and one gas pipeline would be required from each oil and gas processing facility. It is assumed that the oil will be transported to the Bay Area refineries. Tables 5-2 and 5-3 list the number of pipelines which would leave the counties if this option were pursued. It is also possible that pipelines from individual facilities could tie into one "consolidated" pipeline that would take the oil to a common refinery destination.

Offshore Vessel (OS&T) Options

After processing on the OS&T vessel, the oil would be transferred via an OS&T mooring system or SALM directly to tankers for shipment to refineries (see Chapter 3, Figure 3-11 for a diagram of an OS&T operation). Based on a projection of the U.S. flag tanker fleet

for 1986, tankers ranging in size from 31,000 dead weight tons (DWT) to 72,500 DWT would be used to move oil out of the OS&T (Getty 1983). The average size is assumed to be tankers in the 50,000 DWT range. On the average, this size DWT tanker has a capacity of approximately 365,000 barrels (Getty 1983). As stated above, a total of five OS&Ts would be required in the high-case scenario for structures A, C, D, E-F, and G. Estimated tanker visits at each OS&T are listed on Tables 5-2 and 5-3. For the Bodega Basin, approximately 67 tanker visits will occur during the year of peak production under the base-case and 99 visits under the high-case. For the Año Nuevo Basin, approximately 223 tanker visits would occur during the year of peak production under the base-case and 313 under the high case.

Onshore Marine Terminal Options

This option assumes onshore oil and gas processing and crude oil transportation through an onshore marine terminal. In this case the oil industry is assumed to share the use of one "consolidated" marine terminal for each basin. In the Bodega Basin crude oil would be pipelined from the three onshore processing facilities to the marine terminal for temporary storage (3 to 7 days) in a tank farm. Shipment of oil through the marine terminal would require 67 tanker visits a year for peak production in the base-case scenario and 99 visits per year for the high-case scenario (see Tables 5-2 and 5-3).

In the Año Nuevo Basin, oil from both onshore processing facilities (G-H and E-F) would be pipelined to one consolidated onshore marine terminal where it would then be loaded onto tankers. Total shipment from the Año Nuevo Basin (see Tables 5-2 and 5-3) would require 223 tanker visits during the year of peak production for the base-case and 313 visits per year for the high-case scenario. This marine terminal could be located in either San Mateo or Santa Cruz county.



CHAPTER 6

CHAPTER 6

EXISTING ENERGY AND TRANSPORTATION FACILITIES IN CENTRAL CALIFORNIA

The offshore oil development scenarios outlined in Chapter 5 assume that existing energy and transportation facilities in central California will be utilized where possible. For example, oil from Lease Sale 119 is expected to be refined at existing refineries in the San Francisco Bay area, and if tankers are used to transport crude, the existing marine terminals in the bay area would be utilized. This chapter provides the reader with an inventory of the existing facilities in the study area and specifically focuses on facilities which could potentially be utilized if OCS development occurs off the central coast. These include existing refineries, oil and gas pipelines, ports and harbors, marine terminals, airports, and military use zones. Figure 6-1 identifies the location of these facilities.

6.1 REFINERIES

There are no refineries within the six participating central coast counties; however, in Contra Costa, Solano, and Alameda counties in the east San Francisco Bay area there are six active refineries (see Table 6-1 and Figures 6-1 and 6-2). The majority of oil arrives at these refineries by tanker or pipeline. Each refinery has a dedicated, private marine terminal which unloads crude oil from tankers and barges (see Section 6.4). A major pipeline corridor exists between the San Joaquin Valley and the San Francisco Bay area (see Section 6-2) which transports crude to the San Francisco Bay area refineries. Each day the refineries process about 35-million gallons of crude oil, producing more than \$25 million a day worth of gasoline, jet fuel, motor oil, and other products (San Francisco Chronicle September 6, 1988). These products are pipelined, barged, or trucked to distribution centers and/or to end users.

Currently, the refineries get their crude from a variety of sources, including the Alaskan North Slope, Asia, the Middle East, and the San Joaquin Valley. Based on interviews with oil representatives from the refineries, approximately 20 to 30 percent of the crude comes in through pipelines, while 70 to 80 percent is transported to the refineries by tanker (Personal communication, M.A. Lechdenberger and Pete Williams, 1988).

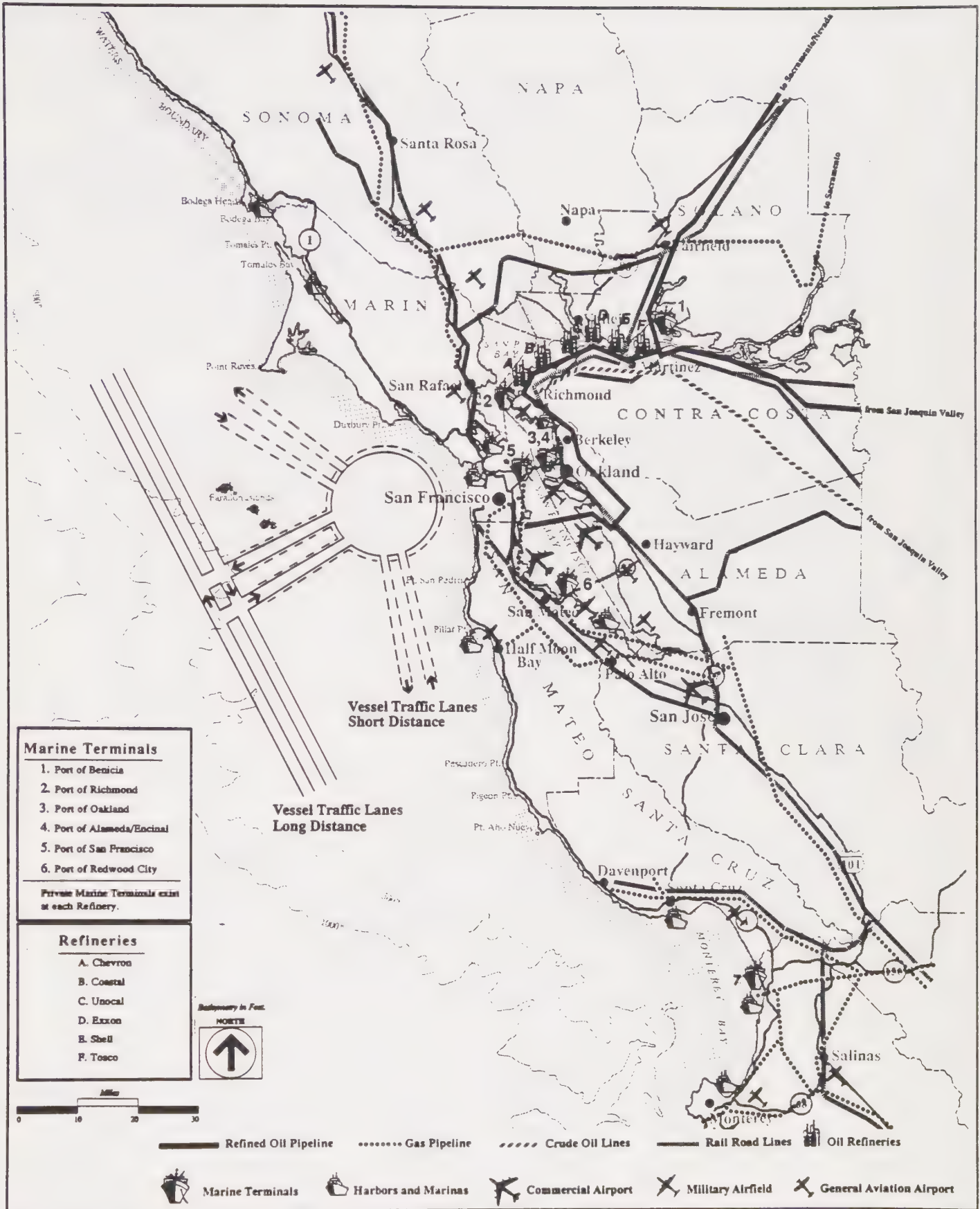
Table 6-1

OPERATING REFINERIES IN THE SAN FRANCISCO BAY AREA

<u>Refinery</u>	<u>Location</u>	<u>Capacity (Barrels/Day)</u>	<u>Throughput (Barrels/Day)</u>	<u>Can Handle OCS Crude</u>
Chevron	Richmond	365,000	260,000	Yes
Exxon	Benicia	130,000	130,000	Yes
Pacifi	Hercules	85,000	40,000	No
Shell Oil	Martinez	140,000	130,000	Yes
Tosco	Martinez	126,000	126,000	Yes
Unocal	Rodeo	100,000	Not Available	Yes

Source: San Francisco Chronicle September 6, 1988, Santa Barbara County's Oil Transportation Plan 1984, and phone interview with refineries.

Note: Capacities vary from source to source. Numbers were obtained directly from company representatives when possible.



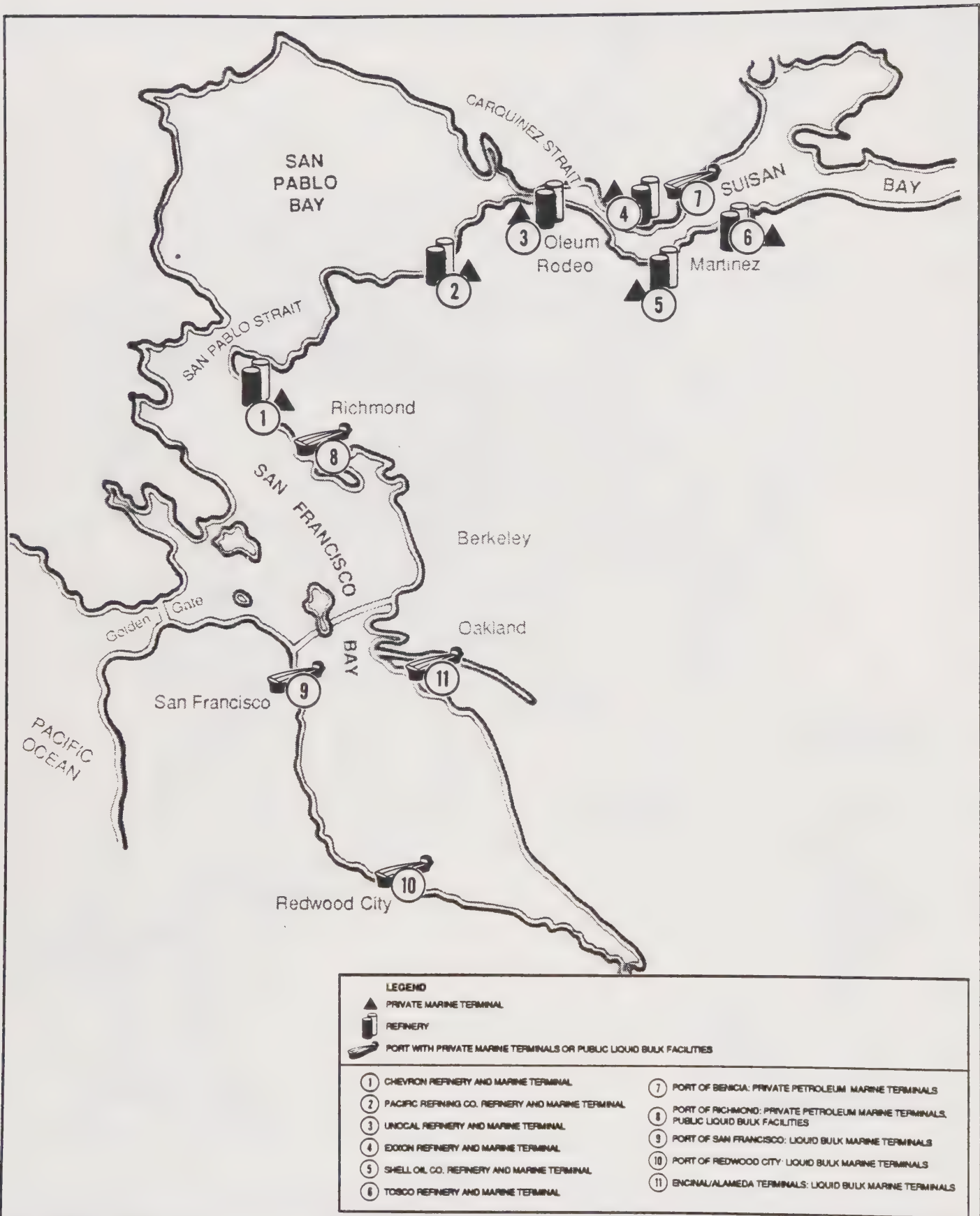


Table 6-1 lists the location and capacity of each refinery. Estimates of refinery capacities vary, depending on which source one uses. Numbers obtained directly from company representatives were used when available, although the numbers varied from those recently published in the San Francisco Chronicle. Refinery capacity is a complex issue which is dependent on such factors as quality of the crude being refined, refinery configuration, and end product mix. It is beyond the scope of this study to address this issue, however the reader is referred to Santa Barbara County's *Oil Transportation Plan* (1984) and *Petroleum Transportation Committee Phase II Final Report* (1983) for an in-depth discussion of the factors which influence refining capacity.

Based on discussions with individual refineries and conclusions presented in the two reports mentioned above, all the refineries in the San Francisco Bay area (except the Pacific Refinery Company's refinery in Hercules) could handle heavy OCS type crude. Central coast crude would need to be transported to refineries by an onshore pipeline, by tankers, or by barges into a refinery's private marine terminal. Onshore pipelines to refineries do not exist at this time and would need to be constructed depending on project demands. Although the refineries are capable of handling heavy OCS crude, depending on market conditions, there may not be existing refinery capacity to handle it. Oil from existing sources could be displaced or, because many refineries in Texas can handle heavy OCS type crude, some producers might tanker their oil to be refined on the U.S. Gulf Coast.

6.2 OIL AND GAS PIPELINES

The major crude oil pipeline corridors in the study area run from the San Joaquin Valley to refineries in the San Francisco Bay area (see Figure 6-1). The major crude oil pipelines from the San Joaquin Valley are owned by Texaco, Chevron, Shell, and Union (see Table 6-2). The total estimated capacity of the pipelines is 302,000 barrels per day (SLC 1981). Pipeline capacity can vary depending on the characteristics of the crude it carries; for example, high viscosity crudes can reduce the capacity of a system by 5 to 30 percent (SLC 1981).

Table 6-2

EXISTING CRUDE OIL PIPELINES
INTO THE SAN FRANCISCO BAY AREA

<u>Owner</u>	<u>Size</u>	<u>Terminus</u>
Texaco	20"	Martinez
Chevron	18"	Richmond
Union	8"	Rodeo
Union	16"	Richmond
Shell	20"	Martinez

A network of pipelines which carry refined products (oil and gasoline) to distribution centers and end users also exists in the San Francisco Bay area, as illustrated on Figure 6-1. There are no existing crude oil pipelines available to transport crude from the coast to San Francisco Bay area refineries. However, if crude was refined in the bay area refineries, existing refined product lines could be utilized for end-product distribution.

PG&E gas pipelines, ranging in size from 8 to 30 inches, transport gas to the coastal counties (see Figure 6-1). This existing network could be utilized to transport gas produced from the Lease Sale 119 area once it is processed to market quality.

In Sonoma County, gas pipelines are located about 15 miles inland from the coastline. In Marin, the major gas pipelines are located in the northeast portion of the county, terminating near Santa Venetia. Several pipelines run from the north tip of San Francisco south into San Mateo County. In San Mateo County, some lines run along Highway 280 while others follow Highway 92 into Half Moon Bay. Santa Cruz County has one major line which is about 5 miles from the coast. Pipelines in Monterey County run along Monterey Bay south through Carmel. South of Carmel in Monterey County, the only major pipeline is about 25 miles inland.

6.3 PORTS

There are six ports in the San Francisco Bay area. These ports are briefly described in Table 6-3.

Table 6-3

**MAJOR PORT FACILITIES WITHIN THE
SAN FRANCISCO BAY AREA**

<u>Name</u>	<u>Cargo Type</u>	<u>Maximum Channel/Depth</u>
Oakland	Container, break bulk, general cargo	35 feet
San Francisco	Container, break bulk, general cargo, ship repair, cruise ships, fishing, dry and liquid bulk	35-80 feet
Richmond	Petroleum, gasoline, fuel oil, kerosene	35 feet
Benicia	Petroleum, bulk, automobiles	38 feet
Alameda Encinal Terminals	Steel, container, bulk liquid	35 feet
Redwood City	Fuel oil, jet fuel, gasoline, lumber, salt, cement, and steel	30 feet

Source: State Department of Transportation 1977 and San Francisco Bay Area Seaport Plan 1982

The Port of Oakland occupies 19 miles of waterfront on the eastern or mainland shore of San Francisco Bay, with more than 550 acres of terminal facilities and 28 deepwater berths. Oakland's port facilities include nine full container terminals and two break bulk terminals (see Section 6.4 for more detail on marine terminals). The Port of Oakland is the largest seaport for general cargo on the bay.

The Port of San Francisco is a very diversified port offering a variety of services, as indicated in Table 6-3. Regarding liquid bulk cargo handling capabilities, the only petroleum activity currently in operation is for PG&E, during periods of bad weather. The port also offers several piers to companies engaged in maritime support services. See the *Golden Gate Atlas* for details on these piers.

The Port of Richmond comprises seven city-owned terminals on a 35-foot depth shipping channel; the principal commodities handled are petroleum products, chemicals, petrochemicals, vegetable oils, molasses, vehicles, and iron and steel articles. The Port of Richmond also encompasses 11 privately-owned terminals, which handle primarily bulk liquid products (see Section 6.4).

Fed by the waters of the Sacramento and San Joaquin rivers, a 350-mile expanse of water forms the upper and inner bays of the region, including the San Pablo and Suisun bays and

the Carquinez Strait. The channel through these bays is being deepened to 45 feet to accommodate larger tankers. The Port of Benicia, a private port, is operated by Benicia Port Terminal Company and is used for import automobiles and outbound bulk cargo. In addition, six major oil companies have private wharves serving their refineries in the area (see Section 6.4).

The Alameda Encinal Terminals, in the city of Alameda, is on an island across the Inner Harbor Channel from Oakland. The port facility is privately owned by the Encinal Terminals Company. Three of the five berths are used for bulk liquids.

Finally, the Port of Redwood City, 18 nautical miles south of San Francisco, is the only deepwater facility in south San Francisco Bay. The port handles primarily cement, lumber, and scrap metal and there are limited facilities for handling liquid bulk and petroleum products. The facilities for petroleum products are currently not in operation.

Table 6-4 lists all the ship arrivals which were recorded in 1986 for all the ports. A breakdown by port is not available; however, the majority of crude oil and petroleum products are shipped into the San Francisco Bay area's proprietary marine terminals. These private terminals are discussed below.

Table 6-4
SHIP ARRIVALS AT THE
SAN FRANCISCO BAY AREA PORTS IN 1986

<u>Type of Vessel</u>	<u>American Flag</u>	<u>Foreign Flag</u>
Break Bulk	22	70
Bulk Carrier	19	677
Container	341	1,039
Other	9	45
Passenger	1	76
Tanker, Chemical	6	33
Tanker, Oil	712	290
Vehicle Carrier	<u>0</u>	<u>258</u>
Total	1,120	2,549

Source: Golden Gate Atlas 1987

6.4 MARINE TERMINALS

Only one marine terminal is actually located along the central coast; all other marine terminal facilities are located within the jurisdictions of the six San Francisco Bay area ports discussed above (see Figure 6-2). This section provides an inventory of the public and proprietary terminals in the study area.

Public Marine Terminals

The Metropolitan Transportation Commission (MTC) and the San Francisco Bay Conservation and Development Commission (BCDC) are in the process of updating their Seaport Plan. One component of this update included an inventory of active marine terminals. However, proprietary petroleum terminals were excluded from the inventory. Table 6-5 identifies the total number of public terminals at each facility and identifies the ports which have liquid-bulk facilities. (Liquid bulk includes crude oil, petroleum products, and other liquid bulk such as vegetable oil fats and molasses.) A total of five public marine terminals have pure liquid bulk capabilities and three terminals provide a combination of liquid bulk and other uses. A total of 48 acres of pure liquid bulk is available in the study area, with an annual throughput capacity of 492,000 metric tons.

Table 6-5
PUBLIC MARINE TERMINALS IN THE
SAN FRANCISCO BAY AREA

<u>Port</u>	<u>Total Number of Terminals</u>	<u>Total Number of Liquid Bulk Facilities</u>
Benicia	2	0
Encinal	2	2 (combination)
Oakland	10	0
Redwood City	4	2 (1 pure, 1 combination)
Richmond	5	3 (pure)
San Francisco	9	1 (pure)

Source: MTC et al. 1988.

An analysis of the ability of these terminals to handle OCS crude is beyond the scope of this study. Most crude oil is transported to the refineries' proprietary marine terminals which are connected to the refineries by a network of pipelines. It is possible that the liquid bulk terminals could handle OCS crude if the terminals were connected to the refineries by

a pipeline. For more details on the public terminals, refer to Future Demand for Marine Cargo Terminal (MTC et. al. 1988).

Proprietary Terminals

Each of the six major refineries has a private marine terminal which unloads crude oil from tankers and barges. As discussed earlier, crude is shipped from areas such as Asia, the Middle East, and Alaska. Tankers which can call on the terminals are limited to about 600 feet in length due to an average depth limit of 35 feet (Personal communication, Jerry Oster 1988). For the large tankers that cannot make port, a crude oil lightering operation is conducted whereby barges shuttle crude oil from the large tankers to shore.

The major proprietary terminals used for receipt of crude oil and receipt and shipment of petroleum products are listed in Table 6-6. Phone interviews to obtain details on tanker traffic were conducted; however, only Chevron and Tosco were able to provide actual tanker traffic volumes. As discussed earlier, in 1986 a total of 712 American tankers and 290 foreign tankers arrived at the terminals in the San Francisco Bay area (Marine Exchange 1987).

Crude from the central coast could be barged or tankered to these existing terminals and unloaded for processing at the refineries. Phone interviews with the refineries indicate that the terminals would have the ability to unload OCS crude, depending on the quality of the crude and what products the refinery wants to produce. Depending on the level of future developments, quality of the crude, and market economics, it is possible there will be a demand in the region for expansion of crude oil terminals; any new crude oil tanker berths will likely be additions to existing refinery terminals (MTC 1981). If the North Bay channels are deepened to 45 feet, fewer, but larger (and more fully loaded), vessels will transport crude to the refineries and additional berths would not be necessary. The terminal facilities at each refinery are discussed below.¹

¹ Summary information from Marine Exchange 1988 and Department of Transportation 1977.

Table 6-6

**PROPRIETARY MARINE TERMINALS USED TO RECEIVE
CRUDE OIL AND SHIP PETROLEUM PRODUCTS**

<u>Owner</u>	<u>Location</u>	<u>Receipt and Shipment of Petroleum Products</u>	<u>Receipt of Crude Oil</u>
ARCO	Port of Richmond	✓	
Chevron	Long Wharf, Port of Richmond	✓	✓
	Point Orient, Port of Richmond	✓	✓
Exxon	Port of Benicia	✓	✓
Holly Corporation	Port of Benicia	✓	
LANDSEA Oil Company	Port of Benicia	✓	
PG&E ^a	Moss Landing	✓	
Pacific Refining Company	Hercules Refinery Wharf	✓	✓
Shell	Martinez Refinery Wharf, Carquinez Strait	✓	✓
Texaco, Inc.	Port of Richmond	✓	
Time Oil Company	Port of Richmond	✓	
Tosco	Eastern Berth Amorcó Wharf, Suisun Point	✓	✓
Tosco	Western Berth, Suisun Point	✓	
Tosco	Avon Refinery Tanker Wharf		✓
Union Oil Company	Rodeo Refinery, Davis Point	✓	✓
Union Oil Company	Port of Richmond	✓	
Wickland Oil Co.	Port of Benicia	✓	

a. This terminal receives fuel oil with a maximum DWT of 50,000 and a maximum draft of 38 feet.

Source: Golden Gate Atlas 1988

Chevron

Chevron receives crude oil shipments primarily at the Richmond Longwharf. This facility is located approximately one and one-third miles northeast of Point Richmond and south of the Richmond-San Rafael Bridge. It has a length of 2460 feet and can accommodate up to four tankers at one time. Tankers ranging in size from 17,000 DWT to 100,000 DWT have been unloaded. Chevron's facility has about 50 tankers and 50 barges arriving each month, unloading 450,000 barrels of oil (San Francisco Chronicle 1988). The oil is temporarily stored in tank farms or piped straight to the plant refinery.

Unocal

Unocal receives crude oil at an offshore wharf located at Davis Point, near Oleum, California. This facility, which has a length of 1250 feet, receives tankers ranging in size up to 50,000 DWT. Tankers of approximately 130,000 DWT (light-loaded) could be accommodated by this facility if the larger tankers utilize a crude oil lightering operation whereby barges shuttle crude oil to shore until the tanker is light enough to come in.

Exxon

Exxon, USA receives crude oil at a dock located at Benicia, on the north side of Carquinez Strait. This facility has a useable berthing space of more than 1000 feet and receives tankers up to 70,000 DWT in size. It could receive tankers of approximately 130,000 DWT (light-loaded).

Shell

Shell Oil receives crude oil at the Martinez Refinery Wharf. This facility has about 1800 feet of useable berthing space serving two berths. Tankers of approximately 40,000 DWT are now received at the facility. If used as one berth, the wharf could accommodate 130,000 DWT tankers (light-loaded).

Tosco

Tosco receives crude oil shipments at both the Amorcio Wharf and the Avon Refinery Tanker Wharf located on the southern side of Carquinez Strait. Tankers of about

90,000 DWT are received at the facilities in central San Francisco Bay. Both facilities could receive tankers of up to 130,000 DWT (light-loaded). Tosco estimates about eight tankers call per month. (Personal communication, Jim Simmons 1988).

6.5 MARINE TRAFFIC LANES

Commercial and military vessel traffic offshore central California is routed through a system of traffic separation schemes and port access routes that are established by the U.S. Coast Guard (see Figure 6-1). A traffic separation scheme (TSS) is an internationally-recognized vessel routine which serves to provide a separation of opposing flows of vessel traffic. A port access route (PAR) generally consists of a precautionary area and associated TSSs. Precautionary areas are defined as areas within defined limits where vessels must navigate with particular caution. A PAR lies off the San Francisco Bay entrance.

Based on a discussion with the U.S. Coast Guard Vessel Traffic Service, none of the vessel traffic lanes are mandatory, yet the majority of large ship operators use the lanes. The exception to this is large tank ships which have drafts deeper than 38 feet; deep draft tankers (38 to 50 feet) cannot use the official traffic lane and are forced to use an alternative route which takes them north of Alcatraz Island to Anchorage Number Nine. Anchorage Number Nine is a general anchorage in the South Bay administered by the U.S. Coast Guard where deep draft tankers unload onto barges (lightering) until they are light enough to come into the bay.

A pilot system is utilized in the bay, where every tanker stops to pick up a licensed pilot who is trained to assist the master in navigating the bay safely. Table 6-7 summarizes the inbound and outbound vessel traffic coming through the bay area.

Table 6-7

VESSEL TRAFFIC IN THE SAN FRANCISCO BAY AREA

	<u>August 1988</u>	<u>September 1988</u>
Inbound Tankers	94	76
Total Inbound Vessels	436	393
Outbound Tankers	170	80
Total Outbound Vessels	415	389

Source: U.S. Coast Guard Vessel Traffic Source 1988

6.6 AIRPORTS AND HELIPORTS

Airports could be used to transport offshore crews into the area. They could also be used as heliports for supply and crew transport to offshore platforms. Information provided by the Federal Aviation Administration (FAA) provides details on public airports including the public airports with space for helicopters. Table 6-8 identifies the active airports and heliports in the study area.

6.7 MILITARY USES

Military activity along the central California coast primarily involves the Navy and the Air Force. The Anchor Bay flight training area is located along the northern tip of Sonoma County. Off Santa Cruz County in Monterey Bay is the Monterey minecraft operating area. Five submarine diving areas are scattered off of Marin and San Mateo counties. Several flight training areas are located off Sonoma, Marin, Santa Cruz, and Monterey counties. In addition, several submarine transit lanes are located off the study area.

The activities include flight training, missile firing and testing, submarine testing, diving, transiting, surface operations, and anti-submarine warfare training. Much of the activity is conducted on a daily basis and is considered vital to overall national security. For the most part, the activity begins at least 6 to 15 miles offshore leaving a fairly wide margin for nonmilitary activity closer to shore.

Table 6-8

ACTIVE AIRPORTS AND HELIPORTS IN THE STUDY AREA

<u>Associated City</u>	<u>Airport or Heliport Name</u>	<u>Use</u>
Sonoma County		
Anderson Springs	Smudged NR 1	Private
Cloverdale	Cloverdale Municipal	Public
Healdsburg	Healdsburg Municipal	Public
Petaluma	Mazza	Private
Petaluma	Petaluma Municipal	Public
Santa Rosa	Santa Rosa Air Center	Public
Santa Rosa	Santa Rosa Memorial Hospital ^a	Private
Santa Rosa	Graywood Ranch	Private
Santa Rosa	Sonoma County ^b	Public
Schellville/Sonoma	Sonoma Valley	Public
Sonoma	Sonoma Skypark	Public
The Sea Ranch	The Sea Ranch	Private
Windsor	Allan Ranch Flight Park	Private
Marin County		
Novato	Gnoss Field ^b	Public
San Francisco	Commodore	Private
San Rafael	Marin Ranch	Private
San Rafael	Hamilton Field	Private
Sausalito	Commodore Center	Private
Sausalito	Commodore Center	Public
San Francisco		
San Francisco	Police Pistol Range ^a	Private
San Francisco	Hall of Justice ^a	Private
San Francisco	Alcatraz ^a	Private
Presidio of San Francisco	Crissy Field	Private
San Mateo County		
Burlingame	Peninsula Hospital ^a	Private
Half Moon Bay	Half Moon Bay ^b	Public
San Carlos	San Carlos	Public
San Francisco	San Francisco International ^b	Public

Table 6-8 (Continued)

ACTIVE AIRPORTS AND HELIPORTS IN THE STUDY AREA

<u>Associated City</u>	<u>Airport or Heliport Name</u>	<u>Use</u>
Monterey County		
Carmel Valley	Carmel Valley	Public
Fort Hunter/Liggett	Tusi AHP	Private
Fort Ord/Monterey	Fritzsche AAF	Private
Greenfield	Metz	Private
King City	Mesa Del Rey ^b	Public
King City	Mee Memorial Hospital ^a	Private
Monterey	Monterey Peninsula	Public
Salinas	Salinas Municipal ^b	Public
Salinas	Quail Creek	Private
San Ardo	San Ardo Field	Public
San Ardo	Texaco - San Ardo	Private
Soledad	Clark Ranch	Private
Soledad	Chalone Vineyard	Private
Santa Cruz County		
Davenport	Las Trancas	Private
San Nicolas Island	San Nicolas Island Olf	Private
Santa Cruz	Bonny Doon Village	Private
Santa Cruz	Dominican Santa Cruz Hospital ^a	Private
Watsonville	Watsonville Municipal ^b	Public
Watsonville	Alta Vista	Private
Watsonville	Watsonville Community Hospital ^a	Private
Watsonville	Monterey Bay Academy	Private

a. Heliports only.

b. Indicates public airports with helicopter facilities.

Source: Department of Transportation, FAA



CHAPTER 7

CHAPTER 7

ENVIRONMENTAL ISSUES AND IMPACTS

This chapter identifies major environmental issues and impacts that could be expected from offshore exploration and development in the central California OCS. Issue areas include:

- Air Quality
- Systems Safety (including oil spills)
- Marine Water Resources
- Marine Biology
- Commercial and Sport Fishing
- Visual Resources
- Land Use
- Recreation and Tourism
- Traffic (marine and onshore)
- Socioeconomics
- Noise
- Solid and Hazardous Waste
- Onshore Water Resources
- Cultural Resources
- Terrestrial Ecology
- Geology

Within each issue area, the activities related to exploration, development, and production are examined, including platforms and subsea pipelines, offshore storage and treatment facilities, onshore oil and gas processing facilities, oil tank farms, marine terminals, pipeline transportation, and supply and crew base facilities. The identification of these environmental issues is based on existing documentation from actual oil activities in southern California and on the impact assessments (EIS/EIRs) conducted for these oil projects. A summary matrix linking oil activities to potentially significant environmental impacts is shown in Figure 7-1.

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT							ONSHORE FACILITIES		
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS*	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES
1. AIR QUALITY	1. Increased ambient levels of criteria pollutants (PM, CO, ROC, NOx, SOx, Ozone) from combustion exhaust sources on exploration vessels, platforms and onshore facilities.	●	●	●	●	●		●	●	●	●		
	2. Increased reactive hydrocarbon concentrations by fugitive emissions from pipelines, tanks and process equipment.		●		●	●		●	●	●	●	●	●
	3. Potential odor nuisance from fugitive hydrocarbons and other gases (such as H ₂ S).									●	●	●	●
	4. Increased ambient non-criteria (i.e., "air toxics") pollutant levels from fugitive and combustion sources.									●	●	●	●
	5. Localized increased levels of particulate matter (dust) during construction, particularly during trenching and grading.					●				●	●	●	●
	6. Potential toxic gas (e.g., H ₂ S) leak in the event of a pipeline rupture.					●					●	●	●
2. SYSTEMS SAFETY (Including Oil Spills)	1. Offshore oil spills could result from well blowout on platforms, pipeline rupture, marine tanker accidents or other equipment malfunction. Spills would enter the ocean, impacting marine environment and habitats on shore.		●		●	●	●	●	●	●			
	2. Onshore oil spills would occur if a pipeline or tank system failed and any containment was breached. Spills could reach surface water bodies, contaminate soils, and damage sensitive environmental habitats.									●	●	●	●

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT						ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS •	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL •	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES
2. SYSTEMS SAFETY (Including Oil Spills) (Continued)	3. A gas release (without fire) that impacts the public could occur in association with system malfunction of onshore gas facilities. Gas could be toxic, posing serious risk to humans and wildlife.									●	●	●	●
	4. A gas release could also result in fire or explosion causing significant damage to the environment, humans, and facilities.									●	●	●	●
	5. Vessel and vehicle accidents could result from transportation of equipment, humans, hazardous materials, and products.	●	●	●				●	●	●	●		
3. MARINE WATER RESOURCES	1. Alteration of physical and chemical characteristics of the water column and ocean sediments due to construction activities, discharge of treated wastewater, discharge of drilling muds and cuttings, and from a major oil spill.		●	●	●	●	●	●	●	●			
	2. Change in water column biochemical oxygen demand (BOD) from discharge of treated sewage from platform.		●		●	●							
	3. Reduction of light transmission in seawater, reduction in oxygen content, degradation of sediment quality due to drilling muds and cuttings, produced water discharges and from a major oil spill.		●	●	●	●	●	●	●	●			
	4. Area-wide increases in barium levels of ocean sediment due drilling muds discharges.		●		●								

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts.

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT							ONSHORE FACILITIES		
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS •	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL •	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES
3. MARINE WATER RESOURCES (Continued)	5. Exceedances of water quality criteria for copper, mercury, and phenol from produced water discharge under low flow, stratified conditions.					●			●	●			
	6. Increased turbidity from pipeline and platform installation and discharges of muds and cuttings.		●	●	●	●			●	●			
	7. Change in water column temperature from discharge of produced waters, cooling waters and oil spills.		●		●	●			●	●			
4. MARINE BIOLOGY	1. Impacts to Areas of Special Biological Significance, marine mammals, marine birds, fish, intertidal species, benthic invertebrates, planktonic species and kelp due to an oil spill.		●		●	●			●	●			
	2. Impact to rare and endangered species, sensitive habitats, and marine resources from an oil spill.		●		●	●			●	●			
	3. Degradation of water quality at Areas of Special Biological Significance due to sewage, drilling muds, produced water, and dredge disposal.		●	●	●	●							
	4. Disturbance of kelp beds and fish habitats due to pipeline installation, disposal of muds and cuttings, vessel traffic, turbidity and oil spills.		●	●	●	●	●	●	●	●			
	5. Disturbance of hard bottom habitat from platform installation and discharge of muds/cuttings.			●									
	6. Impact to marine mammals from general increase in noise due to vessel traffic and platform operations.					●		●		●			

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts.

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT							ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES	
4. MARINE BIOLOGY (Continued)	7. Scattering of fish schools, alteration of fish migration from offshore operational noise.					●			●	●				
	8. Possible disruption of gray whale migration by offshore construction noise.			●			●		●	●				
	9. Impact to seabird nesting or roosting aggregations due to helicopter and vessel traffic noise.							●						
	10. Vessel collisions with gray whales.							●	●	●				
	11. Possible impacts to fish eggs and larvae from seismic testing.	●												
5. COMMERCIAL FISHING, SPORT FISHING, KELP HARVEST	1. Dispersal of fish due to geophysical survey activities.	●												
	2. Exclusion from traditional fishing grounds due to geophysical vessels, construction and operation of platforms and pipelines, and interference from vessel traffic.		●	●	●	●	●	●	●	●				
	3. Gear loss and/or damage and interference with kelp harvest due to seismic surveys, offshore construction activities and vessel traffic.	●		●			●	●	●	●				
	4. Damage to fishery resources and kelp beds due to discharge of produced water and drilling muds and cuttings, vessel traffic and oil spills.		●		●	●	●	●	●	●	●			
	5. Impacts to fish (mortality, tainting), divers, and ecosystem from a major oil spill.		●		●	●	●	●	●	●				

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

FIGURE

7-1
Continued

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT							ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS •	OFFSHORE PROCESSING (OS&I)	MARINE TERMINAL	ONSHORE PROCESSING •	ONSHORE STORAGE	ONSHORE PIPELINES	
5. COMMERCIAL FISHING, SPORT FISHING, KELP HARVEST (Continued)	6. Impacts on mariculture such as direct mortality, sublethal effects, tainting, habitat degradation, and interference with maintenance operations due to an oil spill.		●		●	●	●	●	●	●				
	7. Fouling of fishing gear and boats and lost fishing time due to a major oil spill.	●		●	●	●	●	●	●					
	8. Competition for existing onshore support facilities and port congestion due to exploration, development, and production support traffic.							●						
6. VISUAL RESOURCES	1. Degradation of offshore views due to introduction of industrial visual elements into previously undisturbed landscapes.		●	●	●	●			●	●				
	2. Degradation of onshore views through disturbance of natural landforms, removal of natural vegetation and introduction of industrial elements into relatively undisturbed landscapes.						●	●		●	●	●	●	
7. LAND USE	1. Short-term commitment of coastal land to a use incompatible with its surroundings (and area goals and policies), such as a pipeline or platform staging area in a recreational area.		●	●			●	●						
	2. Long term commitment of land to a use incompatible with its surroundings (and area goals and policies), such as onshore processing facilities in coastal open space and preclusion of future development/use due to hazard footprints.						●	●		●	●	●	●	

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts.

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION				OFFSHORE DEVELOPMENT					ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS •	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL •	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES	
7. LAND USE (Continued)	3. Induced change in land use surrounding offshore oil and gas development facilities, e.g., development of ancillary services (restaurants, housing, etc.) in open space near oil and gas processing facilities.							●		●	●	●	●	
	4. Potential for damage from oil spills to coastal land uses.		●		●	●	●		●	●	●	●	●	
8. RECREATION AND TOURISM	1. Decrease in the quality of recreational benefits or excluding the use of a recreational area due to introduction of, or increase in, area industrial facilities and activities.		●	●	●	●	●	●		●	●	●	●	
	2. Reduction or exclusion of areas normally used for recreational purposes due to oil spill impacts.		●		●	●	●	●	●	●	●	●	●	
	3. Competition for recreational areas due to a possible increase in project-related population growth.		●	●	●	●	●	●		●	●			
9. TRAFFIC (Onshore)	1. Traffic impacts from worker, equipment and supply vehicle trips for exploration, construction and operation of offshore oil and gas facilities.		●	●	●	●	●	●	●	●				
	2. Traffic impacts from worker, equipment and supply vehicle trips for construction and operation of onshore oil and gas facilities and supply bases.									●	●	●	●	
	3. General traffic increases and parking congestion due to induced development supporting oil and gas facilities, their employees and families.				●	●	●	●	●	●	●	●	●	

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT							ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS • OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL •	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES		
9. TRAFFIC (Offshore)	1. Construction and operational crew and supply boat traffic would impact near shore kelp beds.		•	•	•	•		•						
	2. Marine mammals (seals, sea otters) rookeries would be adversely affected by frequent near shore boat traffic.		•	•	•	•		•						
	3. Noise from supply and crew boats impact sensitive coastal and recreational resources.		•	•	•	•		•						
	4. Air pollutant emissions from supply and crew boats can cause violations of federal and state standards for NO ₂ and ozone precursors.		•	•	•	•		•						
10. SOCIOECONOMICS	1. Impact on temporary housing (e.g., hotels or motels) due to construction workers from outside the area.				•	•		•	•	•	•		•	
	2. Increase in the demand for permanent housing from project-related population growth.				•	•		•	•	•	•		•	
	3. Increase in the demand for public services, such as water, fire, police, and schools from project-related population growth. Significant impact where demand exceeds supply.				•	•		•	•	•	•		•	
11. NOISE	1. Increased noise will be generated during construction by vehicles, earthmoving activities, and structure construction. Impact would depend on proximity of sensitive receptors.						•	•		•	•	•	•	

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT							ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS •	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL •	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES	
11. NOISE (Continued)	2. Increased noise from offshore operations could be heard onshore, depending on location and distance offshore. Noise would be generated by equipment such as drill rigs, cranes, generators, and pumps.		●	●	●	●	●	●	●	●				
	3. Increased noise from onshore oil operations would be generated by equipment (pumps, heaters, etc.) and by vehicles.									●	●	●	●	
12. SOLID AND HAZARDOUS WASTES	1. Possible increased demand for landfill capacity due to onshore disposal of drilling muds and cuttings, if RWQCB and EPA determine that ocean discharge is no longer acceptable.		●		●									
	2. Ongoing demand for sanitary landfill disposal (trash) would result from offshore and onshore oil facilities					●		●	●		●			
	3. Hazardous waste treatment or disposal would occur during the life of development projects as a result of production and onshore treatment activities.					●		●	●		●			
	4. Possible increase in demand for capacity at hazardous waste disposal sites and associated increase in transportation of hazardous materials.					●		●	●		●			
13. CULTURAL RESOURCES	1. Destruction of, or interference with, offshore (marine) cultural resources and historic artifacts (i.e., ship wrecks) due to construction abandonment activities, anchor scar and drag marks, buried with discharged materials, and installation of subsea pipelines.		●	●	●		●		●	●				

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT						ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS • OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL	ONSHORE PROCESSING •	ONSHORE STORAGE	ONSHORE PIPELINES	
13. CULTURAL RESOURCES (Continued)	2. Destruction of or interference with, onshore cultural resources, historic places, or artifacts due to construction and activities, unauthorized artifact collection, and oil spills.							●	●	●	●	●	
	3. Degradation of Native American cultural values associated with scenic and natural areas due to increased industrialization, increased human activity, induced ancillary development, and degradation of general environmental quality.		●	●	●	●		●	●	●	●	●	
	4. Degradation or obliteration of potential cultural or archaeological resource base by increased oil and gas development as well as associated support facilities and induced development.								●	●	●	●	
14. ONSHORE WATER RESOURCES	1. Degradation of water quality in estuaries, bays, and rivers could result from offshore oil spills and associated contamination.		●		●	●	●	●	●				
	2. Surface water degradation could occur from onshore oil spills and gas liquids if such spills reached water bodies.									●	●	●	
	3. Groundwater degradation could be caused by onshore oil spills if contaminated soils were not remediated promptly.									●	●	●	
	4. Groundwater and surface water supplies could be impacted by OCS development water needs; this use would lower water tables or stream flows, decrease groundwater or surface water quality, and/or place serious additional demands on local water supplies.					●		●	●	●			

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT							ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS *	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL *	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES	
15. TERRESTRIAL ECOLOGY	1. Loss and/or disturbance of environmentally sensitive vegetation and plant species due to construction and operation of onshore facilities, and resulting erosion and sediment deposition, air pollution, oil spills, and fire impacts.									●	●	●	●	
	2. Loss and/or disturbance of rare, endangered, and/or threatened plant species due to construction and operation of onshore facilities and accidents.									●	●	●	●	
	3. Damage to wetland and estuaries from oil spills.		●		●	●	●	●	●	●	●	●	●	
	4. Loss and/or disturbance of wildlife population and rare/endangered species and habitat due to construction and operation of onshore facilities, and resulting noise, accidents, oil spills, and increased human activity.									●	●	●	●	
	5. Damage to aquatic habitat and biota from construction of pipeline creek crossing and oil spills.									●	●	●	●	
16. GEOLOGY	1. Offshore oil spills, fire, worker safety hazards, NH ₃ or H ₂ S emergency, and/or natural gas explosion due to facility damage from seismic activities (i.e., earthquakes).		●	●	●	●	●	●	●	●				
	2. Onshore oil spills, fire, worker safety hazards, NH ₃ or H ₂ S emergency, and/or natural gas explosion due to seismic activities (i.e., earthquakes) or geohazards such as slope failure or landfills.									●	●	●	●	

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

DISCIPLINE	ENVIRONMENTAL ISSUES / IMPACTS	EXPLORATION		OFFSHORE DEVELOPMENT						ONSHORE FACILITIES			
		GEOPHYSICAL SURVEY	EXPLORATION DRILLING	PLATFORM CONSTRUCTION	PLATFORM DRILLING	PLATFORM PRODUCTION	SUBSEA PIPELINES	CREW AND SUPPLY BASE OPERATIONS •	OFFSHORE PROCESSING (OS&T)	MARINE TERMINAL •	ONSHORE PROCESSING	ONSHORE STORAGE	ONSHORE PIPELINES
16. GEOLOGY (Continued)	3. Damage to seafloor due to vessel anchor scars and drag marks, underwater construction and abandonment activities, disposal of waste materials offshore, and/or induced slumping.	●	●	●	●	●		●	●				
	4. Alteration of onshore topography such as erosion, land slides, cliff retreat, sedimentation, and/or slumping due to construction, operation, and physical presence of onshore facilities (including pipeline landfalls).					●			●	●	●	●	

* Note: Crew and Supply Base Operations and Marine Terminals include onshore components with associated impacts

Summary Matrix of Potential Environmental Impacts
Related to Offshore Oil and Gas Activities

FIGURE

7-1
Continued

The potential environmental effects of various OCS activities that could occur in the vicinity of each county are identified in Chapter 8. This will allow the reader to identify potential effects on the various central coast counties.

7.1 AIR QUALITY

Ambient Air Quality Conditions

Air quality in a particular area depends upon the prevailing weather conditions, local topography, and the locations and amount of pollutants being emitted into the air. Ambient pollutant levels are measured by monitoring the concentration of specific contaminants at selected locations. In order to protect public health and welfare, the state and federal governments have established levels of pollutants which should not be exceeded. The most applicable state and federal standards are listed in Table 7-1. Along the central coast, the pollutant that most frequently exceeds the air quality standards is ozone (O_3). Ozone, a major component in photochemical smog, is formed by the reaction of nitrogen oxides (NO_x) and reactive hydrocarbons in the atmosphere. The six central coast counties are divided into three air districts and all three of the districts have been designated as nonattainment areas for ozone. In other words, these areas do not meet the National Ambient Air Quality Standards (NAAQS) for this pollutant.

Other emissions of concern include nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter less than ten microns in diameter (PM-10). These pollutants are discussed below:

- Nitrogen Dioxide (NO_2): NO_2 is a brownish gas formed in the atmosphere by oxidation of the colorless gas nitric oxide (NO). The pollutant is of concern to regulatory agencies since it is an important precursor of ozone and because of its direct effects on health. NO_2 can also lead to an increase in particulate matter by forming nitrates (NO_3) in the atmosphere.
- Sulfur Oxides: Heating and burning "fossil fuels" like coal and oil release the sulfur present in these materials. In areas where large quantities of fossil fuels are used, sulfur oxides can be a major air pollutant. The largest fraction of sulfur oxides is sulfur dioxide (SO_2). This substance may react with moisture to form sulfuric acid mist (H_2SO_4). These contaminants can damage vegetation and

Table 7-1
Federal and State Air Quality Standards

**COMPARISON OF FEDERAL AND STATE
AIR QUALITY STANDARDS**

Pollutant Averaging Time	Federal Standards Primary	Secondary	State Standard	Objective
Ozone				
1-hour	0.12 ppm 240 µg/m³	Same —	0.09 ppm 180 µg/m³	To prevent eye irritation, breathing difficulties.
Carbon Monoxide				
8-hour	9.3 ppm 10 mg/m³	Same	9.0 ppm 10 mg/m³	To prevent carboxyhemo- globin levels greater than 2%.
1-hour	35 ppm 40 mg/m³	Same	20 ppm 23 mg/m³	
Nitrogen Dioxide				
Annual	0.05 ppm 100 µg/m³	Same	—	To prevent health risk and improve visibility.
1-hour	—	—	0.25 ppm 470 µg/m³	
Sulfur Dioxide				
Annual	0.03 ppm 80 µg/m³	—	—	To prevent increase in respiratory disease, plant damage & odor.
24-hour	0.14 ppm 365 µg/m³	—	0.05 ppm 131 µg/m³	
3-hour	—	0.5 ppm 1310 µg/m³	—	
1-hour	—	—	0.25 ppm 655 µg/m³	
Sulfates				
24-hour	—	—	25 µg/m³	To improve visibility and prevent health effects.
Particulate (PM₁₀)*				
Annual Mean**	50 µg/m³	50 µg/m³	30 µg/m³	To improve visibility and prevent health effects.
24-hour average	150 µg/m³	150 µg/m³	50 µg/m³	
Visibility Reducing Particles	State Standard: One observation. In sufficient amount to reduce the prevailing visibility to less than ten miles when the relative humidity is less than 70%.			
Lead				
30-day Calendar quarter	— 1.5 µg/m³	— Same	1.5 µg/m³ —	To prevent health problems.
Hydrogen Sulfide				
1-hour	—	—	0.03 ppm 42 µg/m³	To prevent odor problems.
Vinyl Chloride (Chloroethene)				
24-hour	—	—	0.010 ppm 26 µg/m³	To prevent health problems

* PM₁₀ = Particulate matter ten microns or less in size.

**Annual Mean: Federal=Arithmetic mean
State=Geometric mean

property and affect the health of humans and animals. SO_2 can also lead to an increase in particulate matter by forming sulfates (SO_3) in the atmosphere.

- Carbon Monoxide (CO): Carbon monoxide is a toxic gas produced primarily from internal combustion engines. A primary pollutant, CO is emitted directly into the atmosphere; thus, concentrations are highest in the vicinity of major CO sources, such as in areas of heavy traffic activity.
- Particulate Matter: Dust, mist, ash, smoke, and fumes are some of the liquid and/or solid particles found in the atmosphere. In many parts of the world natural particles like dust and pollens are the principal source of air pollution. For coastal areas particulate matter standards are usually exceeded due to the large amount of sea salt that accumulate in the air. In industrialized regions, emissions caused by human activities predominate.

Smoke, composed of carbon and other products of incomplete combustion, is the most obvious form of particulate pollution. Open fires, incinerators, petroleum refining and fuel burning in vehicles and aircraft all produce particulate matter. Industrial processes, such as those used in refining crude oil and in manufacturing chemicals, cause particles to form, and liquid aerosols and solid particles form photochemically in the atmosphere when sunlight reacts with certain waste gases. EPA has established ambient standards for particulate matter less than ten microns in diameter, commonly known as PM-10.

Nonattainment Areas

The EPA officially designates areas as "nonattainment" if monitoring data exceed the federal standards. Over the past few years the federal one-hour ozone standard (0.12 ppm) has occasionally been exceeded in the San Francisco Bay area and has been approached in the north central coast. Also, the more restrictive state ozone standard of 0.10 ppm has been exceeded more frequently in both regions. Thus both areas have been designated as "nonattainment" of the ozone standard. Table 7-2 identifies the number of exceedances of both the state and federal standards over the years 1985 through 1987.

Under the Clean Air Act, regions that exceed the air quality standards must develop an air pollution control plan which shows how the standards will be met. Each district has

individual plans and policies which set forth measures that will be taken to attain federal standards.

Table 7-2
**NUMBER OF TOTAL EXCEEDANCES OF THE STATE
AND FEDERAL OZONE STANDARDS**

<u>County</u>	<u>Occurences > 0.10 ppm</u>			<u>Occurences > 0.12 ppm</u>		
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
Sonoma	8	1	9	0	0	0
Marin	2	0	1	0	0	0
San Francisco	0	0	0	0	0	0
San Mateo	12	1	5	2	0	0
Santa Cruz	6	0	0	0	0	0
Monterey	2	0	0	0	0	0

Source: CARB Air Quality Data for 1985, 1986, 1987.

Air Quality Regulations

Air quality is regulated by the local Air Pollution Control Districts (APCDs), California Air Resources Board (CARB), and the EPA. Federal regulations for activities on the OCS are generally less stringent than local APCD requirements. Federal requirements for emission controls on the OCS are enforced by the MMS, and because the federal requirements are not consistent with more stringent local requirements, local areas may be impacted by OCS emissions. Local agencies may experience increased pressure from EPA to compensate for offshore emissions onshore. For example, EPA has required Santa Barbara County to update its Air Quality Attainment Plan (AQAP) to take into account OCS emissions (ERT 1985). The complex interactions of emissions and meteorology make it difficult to show the direct link between OCS development and onshore impacts. Comprehensive planning for air quality is further complicated by controversy over jurisdiction and conflicting regulations. In order to try to resolve these conflicts in regulations, the MMS initiated a negotiated rulemaking process which allowed state and local governments the opportunity to comment on air quality controls for the OCS. The negotiated rulemaking process was an attempt at a mediated forum which included participation by local governments, environmental groups, oil industry representatives, and state and federal agencies. The process did not, however, lead to a consensus rule between all parties. The MMS has

recently published a new draft rule for controlling emissions from OCS facilities. This rule is currently open for review and comment.

Local governments control air quality out to 3 miles offshore through local APCDs. Three APCDs cover the six central coast counties (see Figure 7-2). The Bay Area Air Quality Management District includes Marin, San Francisco, San Mateo, and southern Sonoma counties. Northern Sonoma County APCD includes northern Sonoma County; the Monterey Bay Air Quality Management District covers Monterey and Santa Cruz counties.

Air Quality Impacts

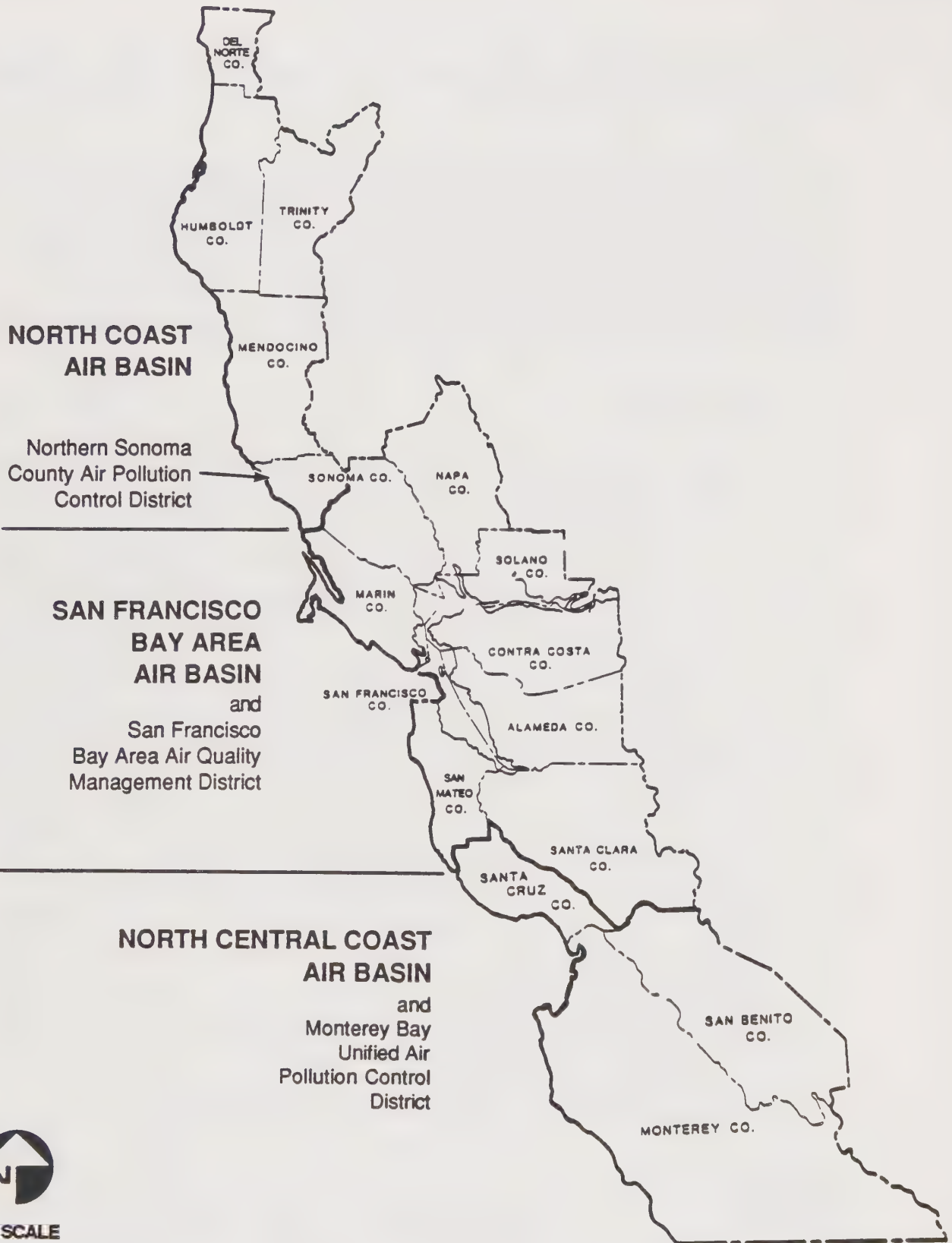
Potential onshore air quality impacts from oil and gas development activities will depend on the type, number, and locations of the facilities that generate air pollutant emissions. As discussed below, each phase of offshore oil and gas development activity will have characteristic air pollution generating sources. Sufficient emissions information is available from recent project-specific air quality analyses to provide a basis for estimating emission levels from the Lease Sale 119 exploration and development scenarios addressed here. The following subsections describe typical emissions for each activity, as well as the most important air quality issues that will need to be addressed. Based on experience in other offshore development areas, particularly southern California, the primary air quality issues will be:

- Effects on onshore ozone nonattainment areas;
- Effects on maximum one hour NO₂ and SO₂ concentrations onshore;
- Electrification of platforms to minimize emissions;
- Obtaining adequate offsets;
- Minimization of fugitive hydrocarbon emissions;
- Minimization of crew boat and supply boat emissions;
- Use of low sulfur fuel for marine vessels; and
- Potential odor effects due to hydrocarbons and sulfur compounds.

Air Quality Impacts

Exploration

The largest pollutant sources associated with the surveying and exploratory drilling phase include the large diesel generators of a jackup rig, semi-submersible vessel, or a drillship (WESTEC 1987). Jackup rigs are more commonly



SOURCE: Air Resources Board

Air Quality Impacts

Exploration

(continued)

used in shallow water. Typically, the drilling unit is moved to the site and positioned by a combination of diesel tugboats and self propulsion. Once positioned over the well site, the rig is anchored to the ocean floor, eliminating the need for additional thruster maneuvering. Diesel rotary well-drilling equipment is used for all wells. Drilling activity is interspersed with running and cementing of casings and well logging and coring to the well's total depth. Well testing involves flaring (combustion) of discovered gas and the use of a diesel test barge to load and transport test fluids to shore. A helicopter and/or crew boat are normally used to move personnel to and from the drilling site. Drilling and testing equipment, fuel, and other materials are transported to the rig by supply boats.

By far the most important pollutant emissions during exploration, in terms of regulation compliance, will be oxides of nitrogen (NO_x) from combustion of diesel fuel. Emissions of NO_x which contribute directly to nitrogen dioxide (NO_2) levels onshore, also act as a precursor to the atmospheric formation of ozone, a nonattainment pollutant in the coastal counties of central California. NO_x emissions can also contribute directly to particulate levels by forming nitrates. For a single site, uncontrolled emissions of NO_x from the diesel equipment described above may be over 3000 lb/day during well testing with more than half of this total due to the diesel generators on the drilling vessel or rig (WESTEC 1987). Most of the remaining emissions are associated with crew and supply boat trips and, during well testing, the test barge. These emissions can be reduced by up to 40 percent through implementation of injection timing retard and use of turbocharging and aftercooling on diesel engines, and control of crew boat and supply boat speeds. All of these measures have been applied in southern California.

Air Quality Impacts

Platform Construction

Construction of offshore platforms will also produce pollutant emissions, primarily due to equipment combustion of diesel fuel. Again, NO_x emissions will be of greatest concern and may average up to about 2500 lb/day over a period of 6 months, depending on the sequencing of installation activities (WESTEC 1987). Maximum daily NO_x emissions could approach 4 tons/day. Diesel-burning vessels and associated heavy equipment (tugboats, workboats, barges, cranes, etc.) are often the most important in terms of compliance with air quality standards, since these vessels can operate near shore and produce relatively high emissions. Obviously, this is of less importance if the subsea pipelines are routed to an offshore processing facility.

Air Quality Impacts

Platform Drilling and Production

Operational phase activities that will produce pollutant emissions will include production drilling followed by, and sometimes overlapping with, production. If electric powered drilling equipment is used, the emissions from both activities will be similar. In cases where electric powered drilling is not feasible, diesel equipment will be used and the corresponding combustion emissions will add to those of cranes and well logging units. The magnitude of routine production emissions will also depend strongly on whether onshore grid electricity can be provided to a platform to meet its power needs. Historically, platforms in the OCS have usually been equipped with gas turbine generators to meet the platform's electrical power requirements. Because of space and safety limitations, control technologies used for similar onshore gas turbines (such as selective catalytic reduction) are not always practical on platforms. However, up to 70 percent control of NO_x for these sources can be achieved by other means such as water injection. In addition some OCS platforms offshore southern California are now

being supplied electrical power from onshore via subsea cable. This occurs in areas where electrical grid power is available.

Depending on the configuration of the platform, the annual NO_x emissions can vary from a low of 5 tons/year for a platform powered by subsea cable, to as high as 250 tons/year for a self-contained platform using gas fired generators.

Air Quality Impacts

Crew and Supply Operations

Equipment and personnel are transported to offshore platforms via supply and crew boats. Typical production operations require that a supply boat visit the platform approximately once a day. Typically, crew boats run from 1 to 2 times per day for crew changes and for moving small supplies (See Table 3-1).

Crew and supply boat emissions are a significant contributor to platform emissions. For electrified platforms, visiting crew and supply boat emissions are the dominant pollutant sources. The magnitude of such emissions will depend upon the availability of crew/supply boat bases in the vicinity of the offshore fields. If nearby crew and supply bases are provided, they will be used extensively. If the distance to platforms is significant, it can be anticipated that helicopters will be used for crew changes. If all boats are required to operate from the existing facilities in the San Francisco Bay area, vessel trip emissions could be substantial.

The emissions from crew and supply boats may provide a greater contribution to onshore project impacts than the percentage of project emissions they produce, due to their proximity to the shore. Typically, crew and supply boats have NO_x emissions in the range of 2 to 7 pounds per nautical mile, depending on the type of engines used (Santa Barbara County APCD 1987).

Air Quality Impacts

Offshore Processing (OS&T)

Emissions from the construction of OS&T facilities will consist primarily of diesel equipment exhaust and support vessel activities. The extent of these emissions will depend to a large extent on the design of the offshore facilities, i.e., whether the OS&T is built on an existing tanker vessel or on a new platform.

Operation of an OS&T will involve emissions from process heaters, compressors, and other oil processing equipment, in addition to fugitive hydrocarbon emissions from storage tanks and valves, flanges, and other connections. Hydrocarbon emissions are reduced to minimal levels by the use of vapor recovery systems. It is probable that such facilities will also require installation of gas turbine generators to meet electric power requirements.

Marine tanker visits to the OS&T will contribute to the facility's emissions of fuel combustion pollutants, primarily NO_x, SO₂, CO, and PM. These emissions would be primarily from tankers' main propulsion and auxiliary generator engines. Pumps for loading crude oil on the tankers could be electric powered units aboard the OS&T, assuming the facility is equipped with sufficient generating capacity, i.e., gas turbines. This approach would produce considerably less pollution than use of the tankers' inboard pumps which would be powered by the vessel's main engines.

Air Quality Impacts

Marine Terminals

Construction of offshore tanker mooring facilities can be accomplished within a few months. If the tankers are to be loaded from onshore storage facilities, loading pipelines to the mooring area will also need to be installed. A rule currently proposed by the bay area AQMD would require all

marine terminals to install vapor recovery systems to minimize atmospheric emission of hydrocarbons. If a new marine terminal installs such a system, it will require additional onshore equipment, i.e., compressors, chillers, sulfur removal unit, and an incinerator or flare to process the recovered vapors.

The marine terminal would normally be constructed adjacent to a tank farm and the storage tanks could also be incorporated in the vapor recovery system. Construction emissions for installation of the mooring will occur primarily due to engines and diesel equipment aboard a pipelaying barge and other workboats. Onshore construction emissions will be similar to those for oil or gas processing facilities.

Operational marine terminal emissions will be dominated by intermittent tanker loading. Crude oil loading pumps will probably be electric-powered units located onshore. Tanker fuel combustion emissions may amount to several hundred pounds of NO_x and SO₂ per visit (typical visit duration is 15 to 20 hours), with peak emissions (40 to 50 lb/hour) occurring during maneuvering into and away from the mooring (Santa Barbara County APCD 1985). Two southern California marine terminals have recently been permitted under strict conditions, including tanker use of low sulfur bunker fuel, a 95 percent minimum vapor control requirement, and limitations on the number of loading operations per year. The likelihood of tanker emissions causing air quality exceedances onshore will depend on the maximum size of tankers permitted to use the terminal and the offshore distance of the mooring facility.

Air Quality Impacts

Oil and Gas Processing

Emissions associated with onshore treatment of produced oil will be similar to those for offshore treatment. However, an onshore facility is more easily operated with power from

Air Quality Impacts
Oil and Gas Processing
 (continued)

existing power lines and is governed by local air pollution regulations. Power from the electrical grid could eliminate the need for onsite power generation. Process heaters, compressor engines, and fugitive hydrocarbons from storage tanks and components throughout the facility will be the most significant air pollution sources. These emissions will occur closer to receptor areas than would be the case for offshore oil treatment plants and will require more mitigation to avoid exceeding local air quality standards. In addition, construction of new onshore treatment facilities will entail short-term diesel and gasoline equipment emissions and dust from site preparation, grading, and installation activities. Assuming that oil treatment only involves upgrading produced crude to pipeline quality, annual operational emissions associated with onshore treatment of about 100,000 barrels of oil per day (bbl/day) can be reduced with mitigation measures, such as the use of low NO_x heaters, to the approximate levels (in tons per year or tpy) shown below (Santa Barbara County APCD 1986):

<u>Reactive Organic Compounds (ROC)</u>	<u>NO_x</u>	<u>SO₂</u>	<u>CO</u>	<u>PM</u>
50 tpy	75 tpy	20 tpy	140 tpy	25 tpy

NO_x emissions can be significantly further reduced if sufficient commercial electric power is available to meet the plant's needs.

Construction of new gas processing facilities will produce temporary emissions of fugitive dust as well as construction equipment exhaust, consisting primarily of NO_x, SO₂, CO, and PM. These activities can generally be managed or phased in such a manner that exceedences of air quality standards can be avoided. Operational equipment that will result in emissions include gas-fuel heaters, sulfur reduction units, flares, fugitives (hydrocarbons), and minor auxiliary

equipment. Again, the availability of sufficient electric power to meet facility demands will be the single most important consideration in terms of NO_x emissions. If off-site electric power can be obtained, emissions associated with onshore processing of about 60 million standard cubic feet per day (MMSCFD), can be reduced with mitigation measures to the approximate levels shown below (Santa Barbara County APCD 1986):

<u>ROC</u>	<u>NO_x</u>	<u>SO₂</u>	<u>CO</u>	<u>PM</u>
50 tpy	68 tpy	45 tpy	20 tpy	7 tpy

As with onshore oil processing, the significance of these emissions will largely be determined by the degree of other planned and existing industrial development in the neighboring area, as well as the current attainment status for criteria pollutants. Emissions of NO_x and ROC are of greatest concern because of the ozone nonattainment status of virtually all central California coastal areas.

Gas processing also has the highest potential of any project component to produce significant localized odor effects primarily because of the high sulfur content of California OCS gas. Such odors can be controlled to acceptable levels in most cases by implementation of strict inspection and maintenance procedures that can reduce leaks from plant components (valves, flanges, connections) by 80 percent.

Air Quality Impacts

Onshore Storage and Pipelines

Excavation, grading, and other site preparation activities, as well as equipment fabrication and installation work will produce temporary emissions during construction. These emissions will consist primarily of fugitive dust and construction equipment fuel combustion products. These activities may be controlled and/or phased to reduce significant offsite impacts. During operations, the only

emissions associated with crude oil storage will be fugitive hydrocarbons, i.e., standing and working losses. These can be minimized to insignificant levels by use of control measures such as floating roof tank designs, double tank seals, and/or a vapor recovery/destruction system. These technologies are routinely included on new projects in southern California.

7.2 SYSTEMS SAFETY (INCLUDING OIL SPILLS)

System safety impacts are those that could result from an accident or upset that releases a contaminant to the environment. Such impacts include oil spills, fires, explosions, as well as explosive releases of gases that could injure, sicken, or kill human beings. System safety impacts can be caused by environmental occurrences (e.g., earthquakes), accidental occurrences due to human error, and by resulting environmental effects (such as damage to biota). Most recent EIR/Ss on offshore oil projects conclude that although the probability of an accident or release is low, the potential results of such an accident can be catastrophic. Thus, system safety is an important part of the environmental review of oil and gas development.

The most recent and comprehensive review of potential accidents was prepared by Santa Barbara County, the State Lands Commission and the U.S. Army Corps of Engineers in their Draft EIR/S for the Shell Hercules Development Project, which included offshore platforms (in state waters), onshore and offshore treatment facilities, pipelines, use of a consolidated marine terminal and support facilities (Santa Barbara County 1988).

Table 7-3 is a modified summary table from the Shell Hercules document which lists potential accident scenarios, their probability, and potential results. Although the Shell Hercules project is located in state waters, similar possible accident scenarios exist for OCS development. The relationship of these types of events to various OCS activities is discussed below, based on relevant data from the Shell Hercules Draft EIR/S. Definitions of frequency of occurrence and severity of consequence are summarized at the end of Table 7-3.

Table 7-3

POSSIBLE ACCIDENT SCENARIOS FOR OCS DEVELOPMENT

Scenario	Potential Impact ^a	
	Probability	Result
CONSTRUCTION		
Offshore oil spill due to collision of tanker with platform during installation.	Unlikely	Severe
Offshore oil spill due to accident with supply boat or pipelaying craft.	Rare	Minor
Rupture of existing gas pipeline due to accident during laying of new pipelines.	Rare	Major
Truck hauling construction materials has accident on public highway.	Likely	Major
Injury to construction workers during plant construction.	Virtually Certain	Minor
OPERATION - OFFSHORE		
Offshore oil spill due to a marine tanker accident.	Likely	Severe
Offshore oil spill due to collision of tanker with platform.	Unlikely	Severe
Vessel collision with platform causing an offshore spill of oil in an amount greater than 360,000 barrels and extensive damage to the platform facilities including rupture of pipelines, risers, process vessels, etc.	Virtually Impossible	Disastrous
Supply boat collision with platform while unloading cargo in high seas.	Unlikely	Major
Collision between a supply or crew boat serving the platform and another private or commercial boat resulting in injury to the public.	Virtually Impossible	Severe
Blowout during drilling or workover with continuing, uncontrolled spill of oil.	Rare	Disastrous
Blowout during drilling or workover with release of oil of limited duration, a major spill.	Unlikely	Major

^a Definitions of probability and result classifications can be found at the end of this table.

Table 7-3 (Continued)

POSSIBLE ACCIDENT SCENARIOS FOR OCS DEVELOPMENT

Scenario	Potential Impact	
	Probability	Result
Spill from a containment vessel or pipework on the platform due to a seismic event.	Rare	Minor
Production riser failure with loss of oil in pipe.	Unlikely	Minor
Operational spill from platform.	Likely	Negligible
Sour gas enters sweet gas pipeline.	Unlikely	Negligible
Leak in sour gas line at platform continues undetected without fire for a few minutes.	Likely	Major
Rupture of the offshore sour gas pipeline near the beach.	Rare	Severe
Rupture of sweet gas pipeline offshore.	Rare	Minor
Rupture of the wet oil pipeline offshore.	Unlikely	Major
Offshore wet oil pipeline is damaged and leaks 200 barrels of oil.	Unlikely	Minor
Rupture of glycol pipeline offshore.	Unlikely	Minor

OPERATION - ONSHORE OIL AND GAS PROCESSING

Rupture of a dry oil storage tank, a tank fitting, or other oil containing vessel pipefitting results in a spill of 1,000 barrels followed by fire.	Unlikely	Severe
Multiple ruptures of facility tanks, towers, pressure vessels, process piping, and tank containment berms such as could be caused by an earthquake are followed by a spill of 20,000 barrels and a large fire.	Rare	Severe
Explosion of a dry oil storage tank.	Rare	Major
Acid gas is released from the sour gas treatment process and continues for several minutes.	Likely	Major
A hose or fitting ruptures during NGL/LPG truck loading, and 10,000 gallons of LPG spill and evaporate without fire.	Unlikely	Major

Table 7-3 (Continued)

POSSIBLE ACCIDENT SCENARIOS FOR OCS DEVELOPMENT

Scenario	Potential Impact	
	Probability	Result
The flammable gas cloud from the evaporating 10,000-gallon NGL/LPG spill ignites and flashed back to the spilled LPG.	Unlikely	Major
Sweet gas is released at the maximum rate near the entrance to the facility, continuing for one minute before shutdown.	Unlikely	Negligible
Sour gas is released into the sale gas line.	Unlikely	Major
Complete break of the onshore wet oil pipeline.	Unlikely	Major
Complete break of an onshore sour gas pipeline.	Unlikely	Severe
Complete break of onshore glycol pipeline.	Unlikely	Minor

OPERATION - TRANSPORTATION ONSHORE

A truck laden with NGL/LPG overturns and spills its contents which ignites immediately.	Likely	Severe
A railroad tank car laden with NGL/LPG is ruptured in an accident, and the escaping gas burns immediately.	Likely	Severe
A truck laden with 20 tons of sludge and untreatable oil overturns, spilling its contents along the highway; no fire ensues.	Unlikely	Severe
A helicopter crashes enroute between the platform and airport.	Likely	Major

Table 7-3 (Continued)

POSSIBLE ACCIDENT SCENARIOS FOR OCS DEVELOPMENT

Scenario	Potential Impact	
	Probability	Result
ABANDONMENT		
Offshore oil spill due to collision of tanker with platform during dismantling.	Unlikely	Severe
Offshore oil spill due to accident with supply boat, crane barge, or other work boat.	Unlikely	Minor
Release of sour gas from pipeline at onshore pig receiver due to accident during purging.	Unlikely	Minor
Release of oil from oil pipeline offshore due to accident during purging.	Rare	Major
Truck hauling salvaged or waste materials has accident on public highway.	Unlikely	Major
Injury to workmen during plant abandonment.	Virtually Certain	Minor

DEFINITIONS OF FREQUENCY OF OCCURRENCE

Called	Frequency	Description
Virtually Impossible	<10 ⁻⁶ /year Or only once in more than 1,000,000 years	This type of event has almost never occurred, but it conceivably could.
Rare	>10 ⁻⁶ /year <10 ⁻⁴ /year Or once in 10,000 to 1,000,000 years	Such events have occurred on a worldwide basis only a few times.
Unlikely	>10 ⁻⁴ /year <10 ⁻² /year Or once in 100 to 10,000 years	Accident occurs, but it is not likely here within project life.
Likely	>10 ⁻² /year <1/year Or once in one to 100 years	Likely to occur during the project lifetime.
Virtually Certain	>1/year Or more than once per year.	Can be expected to occur more than once a year, on the average.

Table 7-3 (Continued)

POSSIBLE ACCIDENT SCENARIOS FOR OCS DEVELOPMENT

DEFINITIONS OF SEVERITY OF CONSEQUENCE	
Called	Description
Negligible	No effect on public health or safety; no facility personnel injuries; no damage to facilities; oil spill of 420 gallons (10 bbls) or less.
Minor	No serious injuries or loss of life; little damage to facilities, no out-of-service time; oil spill of 420 to 10,000 gallons (10 to 238 bbls).
Major	Possible serious injuries or loss of life to some working facility-related personnel, but no injury or loss of life to public; oil spill of 10,000 to 100,000 gallons (238 to 2,380 bbls).
Severe	Injury or loss of life to small number of public, or injuries or loss of life to substantial number of facility personnel; substantial damage to surrounding facilities; oil spill of 100,000 to 15,000,000 gallons (2,380 to 357,142 bbls).
Disastrous	Substantial loss of life; oil spill greater than 15,000,000 gallons (357,142 bbls).

- Notes:
1. Oil spill volume categories up to severe are based on definitions in National Oil and Hazardous Substances Contingency Plan (Council on Environmental Quality, February, 1975; EPA July 1982) and on California's Oil Spill Contingency Plan (State of California, May, 1983).
 2. Categories are only for uncontaminated oil spills which reach either a body of water or unpaved ground.

Source: Santa Barbara County, 1988

Systems Safety

Exploration

Significant system safety impacts are not expected to result from geophysical survey activities.

While oil spills from exploration are rare, there are several operational factors that could result in a major oil spill: above-normal subsurgence pressures, vessel collisions, or severe damage to facilities at the seafloor or on the drilling vessel. The impacts from a major spill would be significant, as discussed in the various spill scenarios in Table 7-3.

Systems Safety

Platform Construction

Impacts during construction are associated with potential marine vessel collisions. These impacts are listed under "construction" in Table 7-3. Construction oil spill impacts are not generally considered to be significant since drilling and production of oil and gas do not occur.

Systems Safety

Platform Drilling and Production

Potential drilling impacts are listed in Table 7-3 under "operation-offshore." A particular concern during well drilling and production on a platform is the risk of a blowout, an uncontrolled discharge of oil and/or gas from a drill hole. A blowout can occur if measures taken to contain the reservoir pressure fail to do so, due to equipment failure, human error, or unpredicted geopressure conditions. Such an event occurred in 1969 in the Santa Barbara Channel and led to the largest blowout related oil spill to date in the U.S. Since that date, changes resulting from increased regulatory requirements as well as improvements in training programs, equipment, and operating practices have greatly reduced the probability of a recurrence of that particular type of event. Even so, it was predicted in recent EISs that blowouts might occur during development of the Santa Maria Basin, but that such accidents are unlikely.

Systems Safety
Platform Drilling and
Production
(continued)

Oil spills might also occur from process and storage systems on the platforms, from a variety of causes including:

- Seismic events, high energy vessel collisions, marine casualties (i.e., a tanker grounding ashore), or spontaneous structural failure events could lead to failure of oil-containing vessels, such as the oil-water production separators which would normally be about one-third full of oil with natural gas in the vapor space. (Severity-minor; frequency-unlikely.)
- Operational errors or mechanical failure of oil pipeline pig launchers (see glossary) on the platforms or the pig receiver on the platform would release wet oil at the pipeline pumping capacity until the system could be isolated. (Severity-minor; frequency rare for extended releases from launchers or receivers.)
- External impacts on the platforms that might cause partial or total destruction of the platform include such events as ship-platform collisions, aircraft accidents, terrorism, and seismic events. If complete structural collapse of a platform were to occur, it is expected that the subsurface safety valves would prevent blowouts from the wells. Nevertheless, oil will be lost from ruptured production well casing/tubing, oil-containing vessels and tanks, and from broken pipelines or risers. The latter would provide the major sources of oil loss and the loss of the platform would result in a relatively large spill. (Severity-major for platform and pipeline; frequency-rare for each.)

Oil spilled into the ocean will spread rapidly, with three dispersion phenomena occurring simultaneously:

- A portion of the oil (which depends on the composition of the oil) will evaporate, causing an air-quality impact, or dissolve in water, leading to degradation of water quality and significant impacts to marine life.
- Another portion (which depends on the sea state) of the oil will form droplets which are dispersed into the water column by wave action, creating a marine water quality impact.
- The oil remaining after evaporation and water column dispersion will form an oil slick on the surface. Depending on the sea state, it may remain as a single slick or be broken into several slickets covering a larger area. Such an oil slick may result in onshore recreational, commercial, and socioeconomic impacts, depending on tidal and current action.

If an oil spill does occur and contacts the shoreline, the resulting degree of coastline pollution cannot readily be predicted. The results of an extensive study of consequences of the Ixtoc I spill on the south Texas coast, indicated that the landfall of approximately 120 tons of oil (200 barrels) per mile caused moderate pollution. For the Ixtoc I spill, heavy pollution was defined as coverage of more than 65 percent of the intertidal zone, while medium pollution referred to average of 25 to 65 percent of the intertidal zone. For some environmentally sensitive areas of the central coast counties, even light pollution could result in significant environmental damage.

Systems Safety

Subsea Pipelines

Important failure modes for offshore pipelines are due to such causes as external corrosion, external impact (e.g., anchor dragging), mechanical defects, natural hazards (e.g., earthquakes), internal corrosion, and operating errors.

Historical data indicate that the first three causes account for the majority of all pipeline failures. If a pipeline leak resulted in an oil spill, impacts would be similar to those discussed above.

Systems Safety

Crew and Supply Operations

Systems safety effects of crew and supply operations are related to the risks of vessel accident. Such accidents are not expected to result in a significant spill or cataclysmic event (e.g., explosion).

Systems Safety

Offshore Processing (OS&T)

OS&T activities would be subject to the same potential risks as onshore processing and other activities - namely oil spills, explosion risk, equipment failure-related accidents, and other leaks. The offshore nature of the OS&T magnifies these risks, however. Exposure to offshore wave and weather events increases the likelihood of accident; the effect from such an accident would likely be greater, since releases would immediately find their way into the ocean. Finally, the presence of a tanker moored to the OS&T increases the potential risk of collision and spill.

Systems Safety

Marine Terminal

Oil spills, particularly major spills, resulting from tanker transportation of oil can have significant effects on marine ecology, recreation, and socioeconomic conditions (particularly related to fisheries and recreation losses).

Possible causes of oil spills include tanker collision at the SALM, channel entrances, or sea lane crossings; groundings at the marine terminal or channel entrances; or operational spills resulting from malfunctions or ruptures in subsea pipelines. The risk of oil spills from tanker transport is directly related to the number of tanker port calls. Spills associated with tanker traffic and operation of marine

terminals greatly contribute to the quantity of oil spills in the California coastal area. Impacts due to a marine terminal and associated tanker traffic would be avoided under an onshore pipeline transportation scenario.

Systems Safety

Onshore Facilities

An extensive list of potential accidents associated with onshore operations is included in Table 7-3.

An accidental oil or natural gas release at an onshore processing facility, pipeline, or tank may lead to one or more of the following consequences:

- Burning pool on land or water;
- Jet fire, from a continuous release from pressurized source;
- Vapor cloud explosion;
- Fireball;
- Vapor cloud dispersion, delayed ignition, and vapor cloud fire or explosion, followed by pool or jet fire;
- Toxic vapor cloud dispersion; and/or
- Flammable vapor cloud dispersion without ignition, and therefore no hazard.

Toxic hazards from natural gas releases would pose a potential problem if the gas were to contain hydrogen sulfide (H_2S). Current estimates are that the project gas will contain between 15,000 to 20,000 parts per million of H_2S , at least initially. Exposure to levels above 1000 ppm can provoke a range of responses from headaches to nausea to respiratory failure and death.

Another potential accident event which could result in the release or spill of hazardous materials would be from the truck or rail transportation of liquified petroleum gas and natural gas liquids (LPG/NGL), byproducts from the gas

Systems Safety
Onshore Facilities
(continued)

processing facilities. The probability of such an event was listed as "likely" and the consequences as "severe" in the Shell Hercules Draft EIR/S (see Table 7-3). Unignited spills of LPG/NGL due to a truck or rail accident could result in a vapor cloud that might disperse harmlessly, or in the event the vapor cloud encounters an ignition source, could result in a vapor cloud fire or explosion. The Federal Highway Administration (FHWA) has been delegated authority to implement regulations (§ 30 of the Motor Carrier Act, 1980) relating to minimum levels of financial responsibility for motor carriers, including elevated levels of financial responsibility for carriers of hazardous materials. FHWA rules are contained in 49 CFR Part 387.

The Federal Railroad Administration (FRA) carries out responsibilities under the Federal Railroad Safety Act of 1970 (45 USC 421) and governs the routing of hazardous materials by rail, including inspection and enforcement functions.

Onshore oil spills may arise from accidental events in the onshore oil dehydration or pumping facilities, or from pipeline leaks and ruptures. It is expected that most spills from facility accidents would be contained by onsite impoundments. The potential consequences and trajectories of unconfined onshore oil spills are particularly sensitive to the specific spill location, as the motion of such spills is essentially dependent upon the local terrain. Onshore spills can generally be controlled and cleaned up to minimize their impact, although spills near estuaries and other wetland areas could be significant. For example, the major 1988 Shell Oil Spill in Martinez spilled 491,000 gallons of oil and much of the oil entered San Francisco Bay wetlands.

7.3 MARINE WATER RESOURCES

Physical oceanography and marine chemistry are addressed in this section. The central California coastal region is part of the much larger California baja coastal current regime, driven by large-scale meteorological forces. The California current carries water, cooled by its passage through the northern latitudes, southward along the shore from the Pacific Northwest to southern California. The basic current pattern is modified by seasonal variations in wind direction that give California's nearshore region its three distinct oceanic seasons. During one of the oceanic seasons, the upwelling period, the upwelling process acts as a conveyor of nutrients from the depths renewing the surface and helping to bring about large phytoplankton blooms, rich zooplankton production, and, therefore, abundant fisheries production.

Exploration and development and production activities can impact marine water resources. Construction activities, discharge of treated wastewater, and discharge of drilling muds and cuttings can alter the physical and chemical characteristics of the water column.

Marine Water Resources

Construction

Construction activities related to platforms, pipelines, marine terminals, and OS&Ts can modify surficial sediments, increase turbidity, and reduce transmission of light. Although there could be short-term impacts on turbidity and phytoplankton productivity, in the long-term, these will most likely be indistinguishable in the highly variable background of natural sources of turbidity (SLC 1984).

Marine Water Resources

Discharge of Muds and Cuttings

The discharge of muds and cuttings has a high potential to impact marine water quality and sediment quality through area wide increases in turbidity and sediment barium concentrations (SBC 1988). Typical discharge volumes are listed in Table 3-3. The ultimate fate of the discharges on the marine environment is dependent on conditions at each site, which can vary greatly.

Upon discharge to the ocean, drilling wastes generally separate into two plumes (SBC 1988). Most of the discharged material (90 percent by weight) descends through the water column with the lower plume; this plume contributes most directly, and in greatest quantity, to materials deposited on the seafloor and directly impacts the benthos (SBC 1988). The upper plume, usually present in the upper 33 to 66 feet (10 to 20 m), contains the remaining lighter material. Based on recent environmental reports, one can assume that there will be a region of heavy drilling mud and cuttings deposition around the platforms, with a region of measurable physical/chemical sediment alteration out to a distance of approximately 6500 feet in the downcurrent direction (SBC 1988).

The discharge of drilling muds and cuttings could result in localized increases in turbidity near the platforms, however such changes are considered to have a low localized impact (SBC 1988). The greatest potential impact from discharge of muds and cuttings is alteration of the physical or chemical characteristics of the sediments. Generally, muds contain bentonite and barite and one could expect measurable alterations in sediment metal levels near platforms (SBC 1988). In some circumstances, muds and cuttings have been required to be disposed of onshore at a hazardous waste landfill.

Marine Water Resources

Discharge of

Produced Water

Wastewater removed during oil dehydration is usually processed through a produced water treating system and disposed of through an ocean outfall. Discharge of produced water can cause a change in water column temperature and can cause an exceedance of water quality criteria. Depending on the exact currents, discharge plumes could impact kelp beds and could be transported to shore and impact sensitive areas along the coastline. Sewage wastes

will be generated during platform construction, drilling, and production; however, the discharge of treated sewage is not expected to have a significant impact on marine water quality (SBC 1988).

Marine Water Resources

Oil Spills

Offshore development and production activities could result in a major oil spill which would have a significant impact on water quality due to possible reduction of dissolved oxygen levels, odor, reduction in light transmission, or direct toxic effects of spill components and/or impurities. The nature and severity of impacts of an oil spill will depend on several factors including volume of spilled oil, location, and the weather during and after the spill. Depending on these various factors, oil residues may persist for years (SBC 1988). Tar-like masses or tar-balls may be formed and are commonly found on beaches after a spill (SBC 1988).

An oil slick will have a major impact upon water quality conditions at the air/sea interface. Dissolved oxygen levels in sea water can be lowered by oxygen-consuming oil components as well as by the impediment of a slick at the air/sea interface. The degree of oxygen reduction will be determined by the extent of the surface slick, the quantities and constituents of spilled oil, and the level of microbiological activity. Light transmission can also be reduced under slicks. Oil incorporated into bottom sediments will affect sediment quality.

An offshore oil spill could have a significant impact on inland and coastal waterways in the study area, as demonstrated by the recent Shell spill in San Francisco Bay. Based on the location of expected development, areas of potential concern include Monterey Bay, Moss Landing Harbor and Elkhorn Slough, Half Moon Bay, San Francisco

Bay, Bolinas Lagoon, Drake's Bay, Tomales Bay, and Bodega Bay and Harbor.

The severity of these alterations will depend on the size of the spill and environmental conditions at the time of the spill. However, it is concluded that a major or catastrophic oil spill would result in significant local and probably regional impacts on marine water quality.

Marine Water Resources

Onshore Facilities

Construction of onshore facilities could result in only minor changes to marine water quality associated with land runoff (SBC 1984). The impacts from an offshore outfall and associated discharges and accidental spills which would reach the marine environment are discussed earlier.

7.4 MARINE BIOLOGY

This section provides a general discussion of the potential impacts to marine life if offshore oil and gas development were to occur off the central California coast. Impacts to the marine environment could result from geophysical surveys, placement of drilling rigs, boat traffic to and from the rig, drilling activities and associated noise, muds and cuttings discharges and potential oil spills. These offshore oil activities can result in significant impacts to intertidal and benthic communities, kelp beds, invertebrates, fishes, marine mammals, Areas of Special Biological Significance (ASBS), and rare, threatened, or endangered species.

Marine Habitats

The marine habitats in the study area include many zones defined by depth or particular community characteristics. For the purpose of this assessment, several major marine habitats are recognized: the intertidal zone (a rocky intertidal shore and a sandy beach are considerably different; rocky shores are the most productive and represent considerable stretches of coastline in the study area); subtidal soft bottom areas; hard bottom areas; and estuaries. Bodega Bay, Tomales Bay, Elkhorn Slough and estuaries in the study area are

key to the ecology in central California because they serve as spawning or nursery grounds for marine fish and invertebrates, habitat for oceanic birds, and supplier of nutrients.

Marine Mammals

Numerous species of whales, porpoises, and dolphins are found off of the central California coast. Grey whales pass off the central coast on their yearly migration from Alaska south to Baja, Mexico, where they breed, and return. Pinnipeds are also commonly found in the study area, including the California sea lion, elephant seal, harbor seal, and the northern fur seal. Sea otters are also found in the study area; this species has recovered substantially from near extinction. (Due to the potentially catastrophic impact to this population by an oil spill, the southern sea otter was designated a threatened species in 1977 by the U.S. Fish and Wildlife Service.)

Numerous birds are present in the study area ranging from oceanic group members (birds which spend most of their lives at sea) to birds like herons and egrets, which populate bays, estuaries, and lagoons. The vast number of both migratory and resident bird species present in the study area are highly sensitive to the adverse impacts from oil spills.

Marine Biology

Geophysical Surveys

Seismic surveys involve the use of an acoustic pulse generator that releases a sound wave which can be interpreted to supply information on underlying geologic structures. Whether or not seismic surveys impact fish or eggs and larvae is an area of current controversy. A recent MMS study titled Effects of Sounds From a Geophysical Survey Device on Fishing Success (MMS 1987e) initially concluded that certain fish do scatter or disperse as a result of seismic surveys, however this study did not examine the actual impact to the fish. Another significant study was jointly sponsored by the oil industry and the fishing community to analyze the impact of seismic surveys on eggs and larvae. The results of this study were recently released in a publication titled, Effects of Airgun Energy Released on the Northern Anchovy, API Publication No. 4453, pp. 108 (API 1987).

Marine Biology

Exploration Drilling

Placement of the mobile drilling rig will impact organisms on the ocean bottom where anchors or legs are placed to position the rig. If a jackup rig is used, it has three legs which occupy about 135 m² of bottom habitat; in comparison, a semi-submersible is anchored to the ocean floor by eight anchors, each of which will drag sand and disturb marine life in its path (SLC 1984).

Installation and removal of the rig will temporarily increase turbidity, creating a short-term impact to benthic communities. The most extensive impacts from exploration come from the ocean discharge of drilling muds and cuttings as described later in this section.

Marine Biology

Platform Installation

Installation of a platform (exploratory or development) involves placement of the platform and anchoring of support vessels on the sea floor. The development platform jacket will consist of eight main legs and will be secured to the ocean floor with main piles driven through the legs and welded to the jacket. Total bottom disturbance of placing the development platform itself is about three acres (SBC 1988). The bottom will also be disturbed by the anchors of the installation barge.

Other impacts from platform construction include disruption of organism activity patterns due to increased turbidity and construction noise. Such disturbances may cause marine mammals, sea birds, and fish to avoid the affected area.

Platform installation and operation noise has the potential to disrupt the gray whale migration (SBC 1988). Movement of tugs, barges, and crew and supply boats through any kelp beds would reduce the canopy, especially if the same route is

used frequently. Finally, helicopter noise is a source of potential disturbance to feeding and nesting bird populations and to pinniped populations, causing temporary abandonment of hauling grounds.

Marine Biology

Disposal of Drilling

Muds and Cuttings

The primary impact to marine biology from exploratory and development drilling operations is due to ocean disposal of muds and cuttings. Oil-contaminated muds and cuttings are separated out and disposed of onshore; uncontaminated muds and cuttings are discussed here. Muds are used to lubricate the drill bit and maintain downhold pressure while cuttings are pieces of rock ground by the bit that are coated with mud. Each time a well is drilled offshore, an average of 1500 to 2000 tons of muds and cuttings are generated and must be disposed of, usually by discharge into surrounding waters (National Academy of Sciences 1983). Research conducted by scientists at the University of California at Santa Barbara suggests that drilling muds discharged to the open ocean even at very small concentrations can interfere with the food finding ability of lobsters and other bottom dwellers, such as crustaceans (National Academy of Sciences 1983).

The most direct impact of drilling muds and cuttings discharges will be on the benthic communities. Burial of organisms by discharges of drill muds and cuttings generally occurred within 320 feet of a single exploratory well in the mid-Atlantic (SBC 1988). Impacts on hard bottom communities are judged to be significant because even low concentrations of drilling muds can diminish the recruitment of hard bottom organisms (SBC 1988).

Fish in the immediate zone of discharge can experience sublethal impacts, such as bioaccumulation of metals and short-term clogging of gills. Ocean discharge of drill muds

and cuttings is alleged to bring about area-wide increases in concentrations of barium, resulting in a lowered productivity and reduction in invertebrate food resources used by fish, although the relative density of barium means that its distribution would be limited. Even so, there is the potential for adverse bioaccumulation effects on both fish and invertebrates that are harvested for human consumption.

Areas of Special Biological Significance in the vicinity of the potential exploratory areas include the Bodega Marine Life Refuge and Bird Rock in Sonoma County and Point Reyes, Double Point, and Duxbury Reef Reserve in Marin County. ASBSs are protected by state law from activities which could degrade water quality in their vicinity. One option to mitigate impacts from drilling discharges is to barge all wastes to shore for disposal at an onshore dump site; this measure alleviates impacts from drilling discharges into the marine environment; however, it creates other impacts due to increased vessel and truck traffic as well as greater demands for and impacts on landfill space.

Marine Biology

Oil Spills

An oil spill poses the greatest threat to the marine biota. Although accidental spills are rare occurrences, in the event of a major oil spill the sensitive natural resources along the coast, including several ASBSs and reserves, could be severely threatened. The exact extent to which an oil spill can inflict long-term damage is not well defined; however, intertidal communities, marine birds, mammals, and shallow-water benthic organisms have been found vulnerable to oil spills. Sheltered environments such as beaches, tidal flats, and marshes are the types of coastlines most vulnerable to an oil spill.

The impact of an actual oil spill on the biota in any area is difficult to predict due to the many factors involved. These

include the type and amount of oil spilled, trajectory and weather conditions, distance from land, response measures employed, and the specific organisms involved. These factors determine how much oil is dispersed into the water column, the degree of weathering before impacting a shoreline, and the final amount, concentration, and composition of the hydrocarbons at the time of impact. For example, Santa Barbara Channel crude oil is low in volatiles and tends to be less toxic than crude oils imported in tankers or refined hydrocarbons such as bunker oil and diesel (Nekton 1983). The Lease Sale 48 FEIS (BLM 1979) discusses the fate of spilled oil in the ocean and oil spill variables, based on oil content and physical and chemical aspects of the environment in which the spill has occurred.

The Año Nuevo State Reserve, near Point Año Nuevo, supports populations of harbor seals, sea lions, and provides a critical breeding site for the northern elephant seals. The majority of pups born in California are born at Año Nuevo State Reserve. This state reserve is the closest sensitive resource which could be impacted by the cluster of development activities in the Año Nuevo Basin.

Sea otters are known to be extremely susceptible to oil and may die if they become fouled with oil. The majority of the population is found in nearshore waters between Santa Cruz and Pismo Beach and a spill from exploratory activities in the Año Nuevo Basin could significantly impact the threatened population. Sea otters depend on the integrity of their underfur for insulation and oiling causes a loss of this integrity, followed by eventual death. Refer to Systems Safety for discussion on the causes of oil spills.

Marine Biology

Pipeline Installation

Depending on the method utilized, pipeline construction impacts include anchor scars, intertidal habitat disruption,

destruction of kelp beds, and benthic habitat disruption. The intertidal zone is directly disturbed by pipeline burial, sediment displacement, and by the movement of equipment on the beach. If an offshore pipeline route in the nearshore area is in a rocky substrate, blasting may be necessary, creating localized impacts to marine organisms. For each pipeline, approximately a 1500-foot right-of-way is disturbed (SBC 1988).

The anchors of a pull barge, the turbidity generated during trenching, and vessel traffic associated with pipeline construction can impact kelp beds. If a pipeline corridor goes through a kelp bed, all kelp plants within a 1500-foot corridor could be damaged (SBC 1988). It is uncertain how long it will take kelp to recover. Kelp recovery could take longer than 5 years if conditions were adverse; even if recovery were to occur sooner, impacts are locally significant because kelp beds are an environmentally sensitive habitat under the Coastal Act (SBC 1988).

Marine Biology

OS&T, Marine

Terminal, Crew and

Supply Boat Facilities

The major concerns related to OS&Ts, marine terminals, and crew and supply boat facilities are noise, vessel activity, and the potential for a major oil spill as a result of a tanker collision, tanker grounding, malfunction, or pipeline rupture. The rough weather conditions typical along the central coast raise concerns over the ability to adequately respond to an oil spill threatening the numerous sensitive resources along the central California coast. OS&Ts pose a greater threat to marine biology than onshore facilities due to the significant impact that would be caused by an offshore spill. Additional impacts to the sea bottom would occur from the anchoring of an OS&T or marine terminal and nearby marine life would be subject to OS&T waste discharges.

Marine Biology

Noise/Vessel Traffic

The noise and activity associated with exploratory and development drilling operations can disturb marine mammals; noise from oil and gas operations could possibly reach a level that would result in the grey whales abandoning current migratory routes and feeding grounds. The vessel traffic associated with construction and production activities could cause an increase in the chance that a boat might hit a marine mammal.

Marine Biology

Onshore Facilities

The major discharge during the production phase will be produced water and gas treatment water from the onshore facilities. Treated produced water, usually discharged via ocean outfalls, is required to meet specific federal and state water quality standards. Produced water discharges can exert chronic effects, most noticeable within 300 to 500 feet from the discharges (SBC 1988). Currents can transport the discharge along the shore, impacting sensitive coastal resources, kelp beds, fish, invertebrates, algae, plankton and ASBSs, depending on the exact location of the discharges.

7.5 COMMERCIAL FISHING, SPORT FISHING, AND KELP HARVESTING

Commercial fishing is a vital industry in the central coast area. The central California coast fisheries include salmon, dungeness and rock crab, squid, northern anchovy, albacore, shrimp, sablefish, shark, sole, rockfish, swordfish, mackerel, Pacific herring, halibut, abalone, white croaker and sea urchins. The predominant fishing methods include: trolling, trawling, trapping, diving, gillnets, and drift gillnet. Bodega Bay, Tomales Bay, San Francisco, Princeton, Santa Cruz, Moss Landing and Monterey are the major ports used to land commercial fish. These ports receive landings representing over 13 percent of the total statewide landings in pounds (MMS 1987b). Sport fishing is also an important industry throughout the area including the use of commercial sport fishing charter boats. Mariculture activities occur for steelhead trout, salmon, striped bass, oysters, mussels and abalone.

Offshore oil and gas development and related activities can have a significant adverse impact on commercial fishing in terms of both fish abundance (due to seismic surveys, outfall discharge, drilling muds and oil spills), fish dispersion (due to seismic activities), and exclusion from traditional fishing grounds (due to obstructions from platforms, marine terminals, pipelines and seafloor debris). Santa Barbara County has documented the significant impacts to fishermen and processors from offshore development and one can expect similar impacts from Lease Sale 119. The significant impacts from OCS exploration, development, and production are discussed below.

Commercial Fishing

Geophysical Surveys

Most of the geophysical surveys conducted offshore California use air guns which emit pulses from streamers towed behind a vessel to detect subsea hydrocarbon reserves. Interference from seismic exploration activities has been identified by commercial fishermen in Santa Barbara County as a major significant impact (SBC 1987a). In particular, the impacts associated with geophysical surveys include: physical conflicts, fish dispersal, and potential damage to egg and larval stages of fish and shellfish resources.

The equipment (streamers) dragged by a geophysical vessel can cut off buoys attached to fixed fishing gear, resulting in the loss of traps and set nets. In the case of deep seismic operations, streamer cables may extend from one to two miles behind the vessel. Salmon trolling is common in the study area and the seismic streamers can tangle with troll lines when a geophysical vessel (see Figure 3-1) is operating in a fleet of salmon vessels (Grader, Zeke 1987). In addition, seismic activities can scare or disperse fish. Although the issue is still controversial, fishermen and recent studies claim that geophysical operations cause a reduction in fish catch (MMS 1987e).

Commercial Fishing

Offshore Development

Offshore obstructions, increased vessel traffic, discharge of drilling muds, cuttings, and wastewater; potential oil spills, and competition for harbor and space facilities impact commercial fishing operations. Specific potential impacts include: dispersal of fish, exclusion from traditional fishing grounds, gear damage/loss, and adverse impacts on habitat and fishery resources.

Platforms, subsea completions, pipelines, and marine terminals can displace fishermen from traditional fishing grounds due to the safety zone required around each obstruction. In addition, seafloor debris (lost or discarded equipment) may create obstructions that result in preclusion of some fishing areas. Trawlers, trollers, and trappers are most likely to have conflicts with offshore structures. Displacement can cause fishermen to spend more time and money looking for new fishing areas. Secondary impacts may occur such as increased competition for fish and loss of resources in remaining fishing grounds due to concentration of fishing activities.

Increased support vessel traffic and tanker traffic can impact commercial fishing through area exclusion, gear damage and/or loss, fish disturbance and vessel discharges. In addition, support vessels can create competition for scarce onshore harbor facilities and create port congestion. Direct, indirect, and induced economic impacts occur due to changes in the level of spending by fishermen in response to a reduction in the amount of catch they harvest.

If an oil spill contacts intertidal zones, covers strands on kelp beds, fouls marine mammals and birds, or exposes pelagic species to toxic chemicals, impact on commercial fisheries is possible. Oil spills impact commercial fishing through reduction of total available catch, death or tainting of fish,

degradation of habitat, contamination of fishing gear and vessels, and prevention of fishermen from leaving port. Fish exposed to petroleum in sediments, water, or dirt can accumulate hydrocarbons leading to harmful biological changes that can affect health and survival (SBC 1988). Species most likely to suffer impacts are mackerel, and anchovy, which live near the surface (SBC 1988).

Fish can be affected directly by oil spills, either by ingestion of oil or oiled prey, through uptake of dissolved petroleum compounds through the gills, through changes in the ecosystem supporting fish or through effects on fish eggs and larval survival (SBC 1988). A severe spill could damage large numbers of eggs or larvae of a species causing a reduction in new fish for that year. If a spill were to contact salmon smolts as they were emerging from their stream, an entire genetic strain could be lost.

In addition, commercial fisheries, can be affected through fouling of boats and equipment, closure of fishing seasons, or buyer resistance to tainted or suspect products. Fishing time lost, especially during a peak or highly productive season, is directly translated into dollars lost.

Commercial Fishing

Sport Fishing, Kelp Harvesting, and Mariculture

Potential impacts to sport fishing include fish dispersion due to seismic testing, exclusion due to offshore development activity, and oil spills. An oil spill could have a significant adverse impact that could extend through to the local tourism industry.

Kelp harvesting and mariculture would be impacted by offshore construction activities and vessel traffic. Kelp harvesters are impacted if the beds they frequent are impacted (SBC 1988). Construction activities could destroy sections of the beds with anchor movements and turbidity,

while vessel traffic could destroy the kelp canopies. Discharge of muds and cuttings and produced water could degrade water quality locally and negatively impact kelp beds. An oil spill could impact the kelp industry through fouling of boats, gear, and the kelp itself. Actual or perceived tainting could render kelp unsaleable (SBC 1988). Degradation of kelp beds would have adverse effects on fish and sea urchins which depend on kelp for habitat. This would lead to negative impacts on sport fishing, spear divers and other fishermen who use kelp forests as fishing grounds. In addition, adverse effects to abalone mariculture may result from depletion of kelp beds, since kelp is used as feed.

Mariculture operations can be impacted in much the same way as kelp harvesting by offshore activities such as ocean discharge of drill muds and cuttings, produced water and other operational discharges, and by vessel traffic. Oil spills can affect mariculture through the death or tainting of organisms.

7.6 VISUAL RESOURCES

Environmental impact analysis determines visual impacts based on considerations such as: the visual character and components of an area; the visual quality of these characteristics; and the visual sensitivity level of an area based upon viewing expectations, durations of particular views, and frequency of viewing. Integrated with these considerations are project specific factors such as proximity and relative scale of project features to surrounding visual elements, as well as compatibility of project features with existing visual characteristics.

The predominantly undeveloped scenic character of the central California coastline contributes to the uniqueness of this area. Highway 1 parallels the California coast and represents the primary (in most areas the only) access to this unique view area. In recognition of the special nature of this roadway, many miles are officially designated and protected as Scenic Highway. In fact, Route 1 is designated as Scenic Highway from the

southern border of the study area to Route 35 near Daly City, from Route 35 to Route 480 in San Francisco, and again from Route 101 in Marin City all the way to the northern border of the study area and beyond (personal communication Stoker, California Department of Transportation 1988). Given that this road is not used as a primary north-south thoroughfare, it is assumed that the majority of Route 1 trips are made with the express purpose of enjoying the extensive, unbroken spectacular views.

Based on these considerations, the introduction of offshore oil and gas development and processing facilities into visually sensitive areas will have a significant adverse visual impact on these undeveloped and scenic portions of the project area. Visual impacts to developed areas must be determined on a case by case basis using the considerations outlined above.

Visual Resources

Offshore Development

Project components from exploratory drilling to laying of subsea pipelines all require varying durations of offshore activity which in turn will have a range of effects on visual resources in the area. Depending to a large degree on the activity's distance (miles) from shore, visual resources may be affected by presence of construction and operation features of offshore oil and gas development and processing facilities. Described in detail in Chapter 3, these features include construction barges and other vessels present during exploration/production support; drill rigs; vessels used for supplies; and transport vessels for produced materials. The most visually evident element of offshore oil and gas development is platform construction which involves the marine supply operation including the deployment of derrick barges, jacket launch barges, cargo vessels, tugboats, supply boats, and occasional helicopters. Crew boat and supply boat traffic is most visible during installation of subsea pipelines and during platform jacket set-up. Later, during the operation of offshore facilities, vessel traffic is reduced as the need for supplies at offshore facilities declines. Visual impacts of boat traffic are generally not significant due to the relatively small scale of supply and

crew boats and their overall compatibility with other marine traffic, if such traffic exists in a given project area.

The long-term visual presence of offshore oil and gas facilities during operation is a source of potentially significant visual impacts. In daylight conditions, the most conspicuous elements of offshore platforms are their decks and supporting legs, crew quarters, cranes, and cantilever masts. These components combine to give the platform its above surface bulk and mass. Lighting of the facility and flaring increases evidence of the platform at night, although details of the facility may not be perceptible.

Visual impacts of offshore platforms and of OS&T facilities can be significant depending upon the distance at which facilities are viewed (miles from shore, size of equipment), prevailing visibility conditions such as fog and haze, and site-specific viewing conditions including duration of view, orientation of view, and the amount of screening present. Because of these factors, visual impacts of offshore facilities can vary widely from minimal to significant as viewing locations and meteorological conditions change over distance and time. As is shown in Chapter 5, platforms could be located between 3 and 12-miles offshore, which would make them highly visible from the coastal zone thereby increasing their visual impact. Visual impacts would also be significant due to the present pristine quality of most of the study area.

Visual Resources

Onshore Facilities

A variety of onshore facilities are involved with the processing and transportation of oil and gas resources. These include oil treatment facilities, gas processing facilities, oil storage tanks, marine terminals and transportation facilities, pipelines, supply and crew base

Visual Resources
Onshore Facilities
(continued)

facilities and associated piers and docks. Visual impacts will be associated with the construction of facilities as well as with their long-term operation.

Reductions in visual quality as a result of construction of onshore facilities will result from disturbances to landforms and vegetation as well as the visual presence, operation, and storage of equipment and materials out of character with their visual surroundings. Localized disturbances and the presence of equipment and materials could be expected in the construction of oil pipeline and treatment facilities, gas processing facilities, tank farms, marine terminals, and supply and crew base facilities. Transportation pipelines, due to their linear configuration, could result in disturbances over many miles and feature the presence of work crews and construction equipment progressing along the route of the facility. In many cases, the surface disturbance from pipeline construction remains along the right-of-way (50 to 100 feet wide) until sufficient revegetation of natural species occurs.

The long-term visual presence and operation of onshore facilities can result in significant visual impacts, depending on the degree to which facilities are within public view and the visual context (landscape) in which they are seen. Factors affecting the visibility of facilities include their overall size and area, the amount and extent of screening available, their proximity to viewers (points accessible to the public), the predominant orientation of views from a given point relative to the facilities, and the duration of a given view of a facility. Areas which are visible to the public where facilities of industrial character do not presently exist are inappropriate or incompatible landscape settings for onshore oil and gas facilities. Oil treatment facilities, gas processing facilities, and tank farms are industrial in character. This is due to typical physical components of

these facilities and their configuration. Marine terminal and transportation facilities, pipeline transportation facilities, and supply and crew base facilities are considered light industry in terms of their general appearance; however, they still add a visual sense of industrialization to an undeveloped area.

7.7 LAND USE

Appendix B discusses county land use plans and policies and identifies the major land uses, significant natural resources, and recreational opportunities along the central coast. The following overview of land use in the study area augments Appendix B.

The majority of the central coast is characterized by sparsely developed coastal areas dominated by coastal bluffs and terraces, rolling hillsides, and spectacular scenery. The primary land uses along the central coast are recreation, agriculture, and open space. The main exceptions to the area's rural character are the urban, suburban, and industrial development in the San Francisco Bay area (see Chapter 6).

Onshore facilities related to offshore development include processing plants, tank farms, supply and crew base facilities, and pipelines, all of which have the potential to significantly impact land use. Short-term land use disturbances occur during project construction due to the physical presence of construction activities and equipment. Long-term land use impacts occur due to both the permanent commitment of land to energy-related use, and the potential for the spread of industrialization to nearby areas.

Along the central coast, land use within the coastal zone is regulated by each county's individual Local Coastal Program (LCP). As discussed in Appendix B, each central coast county has specific policies which limit or discourage onshore facilities related to offshore development. Since very little oil-related infrastructure currently exists in the study area, any commitment of coastal land for oil and gas development represents potentially significant land use impacts.

Land Use

Offshore Development

Exploration activities will have a limited impact on long-term land use conditions. Temporary exploration crew and supply bases are usually located at existing facilities and if

so, would present minimal impacts to existing land use. Platform and subsea pipeline construction generate short-term land use impacts because some land is required onshore for a temporary staging area. If a pipeline comes onshore near a sensitive habitat or recreational area there is the potential for land use inconsistencies in the tidal area. Oil spills from offshore operations could disrupt coastal land uses for periods of time depending on the size of the spill.

Land Use

Onshore Facilities

Offshore platforms and pipelines have an indirect impact on land use, since these activities require onshore processing facilities, pipelines and support operations such as crew and supply bases, marine terminals, and auxillary facilities (roads, service needs, etc.). These onshore oil facilities present adverse land use impacts. Land use impacts associated with onshore facility construction depend on facility size (particularly the amount of land the facility will occupy) and location. Table 3-5 lists the typical acreage required for various onshore oil and gas facilities. The degree of impact adversity depends upon location of the oil and gas development and existing land uses in the area. Such a facility may be a compatible use in an area zoned for heavy industrial use, but incompatible in a residential neighborhood. A change in the zoning for the selected site may be necessary. The project's consistency with stated planning goals and policies for the site vicinity would have to be evaluated. Coastal land uses could be disrupted due to oil contamination from a rupture in processing facilities, tanks or pipelines.

Five of the central coast counties have passed oil initiatives which limit or discourage onshore facilities related to offshore oil development (see Appendix A). Therefore, it will be difficult to obtain the necessary land use permits for onshore support facilities related to offshore development.

Operation of an oil or gas treatment facility or marine terminal would mean committing the land it occupies to long-term industrial use. Indirectly, an existing oil or gas treatment facility could also set precedent for further industrial development in the area.

Construction of a buried pipeline results in temporary disturbance of a right-of-way approximately 100 feet wide, averaging around 12 acres per mile of pipeline. Additional land (approximately 20 acres) is required for construction of each pump station.

Permanent land use impacts stem from pipeline operation. A permanent right-of-way (ROW), typically 50 feet wide, is required for pipeline inspections and maintenance. This ROW would remove about 6 acres of land per mile from previous uses. In some areas, such as grazing or industrial lands, the change may not be discernible. In other areas, especially forests or agricultural areas, the cleared right-of-way would contrast with surrounding uses. If not constructed in an existing utility corridor, a pipeline could encourage future parallel linear land uses as a result of government regulations encouraging right-of-way corridor sharing. Secondary land use effects could occur as a result of a new pipeline ROW providing new public access to previously undisturbed areas.

7.8 RECREATION/TOURISM

As illustrated on Figures 8-1a, 8-1b, 8-2a, and 8-2b, numerous recreational and natural resource areas are found along the central coast. In fact, of the 350 miles of central California coastline, approximately 39 percent is composed of recreational areas (MMS 1987b). Appendix B summarizes some of the key recreational resources along the coast. The variety of unique natural resources and recreational areas attracts many visitors to the central coast making tourism an important aspect of the economy. Predominant offshore

recreational activities include wind surfing, surfing, sport fishing and boating. Onshore, the federal and state parks and beaches attract hikers, campers, and natural resource enthusiasts. The rugged shore provides opportunities for studying and observing natural vegetation and wildlife. If development activities change the character of coastal areas, tourism and recreational activities could be impacted. The level of significance of impacts will vary depending on the level and location of the development.

The major factors promoting tourism activity in the central coast area include the following: the physical attractiveness and pristine environment of the area's natural resources including seashore and inland resources; the area's many recreational, park, and campground facilities; the reputation of the area as a tourism destination for a variety of reasons including historical and architectural features; the relative lack of development for the majority of the study area; extensive access to the coastline; and other factors including the existence of Scenic Highway 1 through the region.

Potential impacts on tourism in the area include:

- The decrease in pleasurable sightseeing and recreational activities that could result from industrial facilities within coastal and rural settings or from a major oil spill (offshore or onshore).
- The potential unavailability of hotel/motel rooms and/or camping sites due to their use as temporary housing by workers involved in project construction.
- Crowding of recreational areas due to population increase from imported labor for offshore oil and gas development.

Siting of onshore facilities will most likely change the character of the coast and thereby impact recreational uses of that area.

Recreation/Tourism

Offshore Development; Onshore Facilities

Installation of offshore platforms and pipelines will cause short-term impacts to offshore and onshore recreational activities. Water-dependent recreational activities such as surfing, swimming and recreational boating would be

Recreation/Tourism
Offshore Development;
Onshore Facilities
(continued)

prohibited in the construction area. Noise from construction related activities could impact nearby recreational area use.

Construction of onshore facilities may directly impact recreation areas or have a short-term impact on recreational activities, depending on where the facilities are located. Construction workers could displace recreational campers at public and private campgrounds as well as compete for space and time at other recreational areas. Operation of onshore facilities may additionally impact recreation through degradation of area resources. Onshore facilities could also result in industrialization of undeveloped areas, causing tourists to go elsewhere.

During drilling, production, transport, and storage operations, there is the potential that a blowout or other accident could occur resulting in an oil spill with the potential for temporarily interfering with use of recreational resources and facilities. The extent of these impacts would be dependent upon the volume of spill, its origin, its trajectory, and the effectiveness of containment and cleanup activities. If a spill was to occur, the experience of individuals engaging in recreational activities (e.g., hiking, surfing, sport fishing, scuba diving) would be at least adversely impacted if not precluded. The exact duration of the impact will vary, depending on the success of clean up measures and amount of oil spilled.

Based on the expected location of development (see Chapter 5), recreational resources off of Sonoma, Marin, San Mateo and Santa Cruz counties will be at greatest risk from spills due to offshore platforms and pipelines. If offshore tankers are used to transport the oil, the coastal resources of all the counties would be subject to impacts associated with a tanker oil spill.

7.9 MARINE AND ONSHORE TRAFFIC

Generally, impacts to traffic from a proposed project are determined through several steps: 1) identifying existing area transportation means and volumes (automobile, public transportation, truck, train, airplane, helicopter, and marine); 2) assessing transportation conditions and capacities (how much and how well can a port/road/rail line handle in terms of potential increase); 3) determining project-related traffic increases in each area; and 4) evaluating projected levels of service for each means of transportation (level of service [LOS] is a ratio of volume to capacity). Site-specific information, including project-specific information, is required to conduct such a study. This precludes its performance and inclusion in this report, although an overview of potential project-related impacts is discussed below.

Traffic

Marine

Oil development in the Bodega and Ano Nuevo basins will add to the levels of marine traffic utilizing the coastal waters and existing ports and harbors in the study area. Project-related marine traffic will include crew and supply boats, tugs, exploration rigs and vessels, construction barges, and marine tankers. These vessels will interact with existing cargo, military, commercial, sportfishing and recreational fishing vessels. The environmental effects of these interactions are as follows:

- Increased use of vessel traffic lanes by crew, supply and other oil-related boats creates increased risk of collisions and marine oil spills.
- Crew and supply boats and tankers will impact general and recreational boating, commercial, and sportfishing activities.
- Oil-related vessel activity by crew and supply boats and tugs will increase competition for berth space and crew base areas at existing ports and harbors in the study area.

In terms of conflicts with recreational boat traffic, a 10 percent increase in oil-related traffic in a high recreational boating-use area would constitute an adverse, significant impact (SBC 1988). A discussion of crew and supply bases and boat traffic is provided in Chapter 3. An inventory of the existing ports and harbors that could be impacted by this increase in traffic is provided in Chapter 6.

Traffic

Onshore

Primary study area transportation facilities are shown on Figure 6.1. For most of the study area, coastal access is limited to Route 1 which parallels the coastline for most of the north-south length of the area. Periodic east-west interchanges exist, but for the most part neither these nor Route 1 are major thoroughfares. Only in the San Francisco City area and near the cities of Monterey and Santa Cruz does Route 1 serve as a major roadway.

Onshore facilities related to OCS oil and gas development are anticipated to be located in southern Sonoma County, southern San Mateo County, and northern Santa Cruz County. Without details such as site locations, project traffic increases, and baseline traffic conditions, actual areas of potential impacts are uncertain. Project activities which may pose increases to traffic include: worker, equipment, and supply vehicle trips associated with construction and operation of offshore facilities; worker, equipment, supply and other related vehicle trips associated with construction and operation of onshore facilities; worker, equipment, and supply vehicle trips associated with construction and maintenance of onshore pipelines; traffic increases in residential areas supporting influx of oil and gas personnel and their families; general traffic increases due to induced development supporting oil and gas industry and its employees; and parking (wherever facilities and loading points are located).

Along with the potential of increased traffic levels, onshore facilities related to OCS development may include transport of liquefied petroleum gas or natural gas liquids (LPG/NGL) by truck or rail. Vehicular transport of such materials presents a system safety-related risk in addition to those of the facilities themselves. Please see Section 7.2 for a discussion of LPG/NGL transport risk.

7.10 SOCIOECONOMICS

The first step in a socioeconomics impact analysis is to define the current and future baseline in the absence of offshore oil and gas development. Next, a model is usually utilized to determine project related population impacts, which are then used to calculate impacts on regional growth, housing, public services, and public finance. Offshore development of oil and gas resources results in an increase in local employment through hiring of workers and an increase in local expenditures from the purchase of goods and services. The degree of local employment varies widely, as skilled oil workers often come from other areas, thus decreasing the use of available local workforce. Although the creation of new jobs can have beneficial impacts, the benefit depends on the magnitude and location of development. Local populations can increase as people move into an area to take direct and indirect jobs, which in turn triggers demands for temporary and permanent services.

Project related requirements for public services include additional police and fire protection, increased demand for water, increased demand on solid waste and wastewater systems, and increased enrollment at public schools. If large expenditures are required to meet these needs, negative fiscal impacts on a community can occur from a project. Property taxes are the major source of direct revenue from oil and gas development projects.

In Santa Barbara County, the Socioeconomic Monitoring and Mitigation Program (SEMP) was developed to monitor actual project-related impacts and to develop mitigation programs to reduce the impacts identified. Because Santa Barbara's socioeconomic characteristics differ greatly from the central coast, it is difficult to make a projection of potential impacts in central California based on Santa Barbara's experience. However, some general trends can be identified based on the SEMP report. Although large amounts of money are spent

by operating companies (in 1986 a total of \$219,478,817 was spent in Santa Barbara, Ventura, and San Luis Obispo counties), only a fraction of these monies remain in the local economy long enough to generate population impacts.¹

The money spent by oil and gas companies in 1986 generated an estimated population increase of 2259 persons in Santa Barbara County (SBC 1987b). According to the latest SEMP report, this population increase resulted in an estimated increase in demand for public services between 0 and 9.9 percent. Although population increases for Santa Barbara County were small, they represented significant impacts in communities where the demand for services such as sewage treatment, water, school capacity, or affordable housing already exceed supply.

Information in the latest SEMP report indicates that on the average, oil and gas employees have 2.7 residents per household and .3 school aged children per household. Overall oil and gas plant construction and operation, and onshore pipeline construction generate the largest population-related impacts. Offshore processing could still generate onshore socioeconomic impacts, without generating any revenue from property tax for local governments. A detailed analysis of the socioeconomic baseline is being conducted as a separate study for the Regional Studies Program and should help local governments get a better understanding for areas of potential concern.

Socioeconomics

Exploration

Seismic survey vessels and exploration rigs come with their own crew; therefore, new employment opportunities are minimal. The temporary nature of exploratory drilling makes it unlikely that employees would move their families and homes into the study area. Increases in employment in the service and support industry may cause an increase in population. Since minimal employment and population increases are expected as a result of exploration, no housing demand impacts are expected (MMS 1985a).²

¹ Please refer to 1986 Tri-County SEMP report for additional information on expenditures and impacts.

² For more details see MMS, 1985, Facilities Related to OCS Oil and Gas Development Offshore California: A Factbook, October.

Exploration activities can put a demand on water and waste disposal. The impacts on water vary depending on the source utilized; the greatest impact occurs when water from a municipal system is hauled to the drilling rig. Waste generated during exploration, which cannot be disposed of in the ocean, is hauled by supply boat onshore and disposed of at an appropriate landfill.

Other public services, such as sewers, police and fire protection, and schools, would not be affected by offshore exploration because no direct population and employment increase would occur (MMS 1985a).

Socioeconomics

Offshore Development

Direct impacts from platform installation and hookup and development drilling may result from a project and its related population (MMS 1985a). Impacts from platform installation would be minimal because most workers come with the barge; however, direct population increases can result during development drilling. The level of impacts from drilling on population, housing, and public services depends on the number of new workers who relocate to an area.

Like exploratory drilling, development drilling places demands on water and waste disposal.

Direct impacts from platform production can result from a project and its related population. New direct employment opportunities associated with platform production vary by project and individual company. Total workers on a platform range from 8 to 40 and usually there is a mix of people from within and outside the area (SBC 1988). Direct demand for housing and related public services would depend on the number of new employees who relocate to the area.

Socioeconomics

Onshore Facilities

Onshore pipelines, marine terminals, processing facilities, and support facilities can create an increase in local population, resulting in direct socioeconomic impacts. Pipeline construction and oil and gas processing facilities generate the greatest population impacts, resulting in an increased demand for housing and public services. Santa Barbara County's experience reveals that workers from outside of the area actually will move themselves and their families into the area for an oil-related project, resulting in an increased demand for housing, police, fire, schools, water, and sewage treatment. The financial costs of supplying these services may not be offset by local taxes, placing the burden on the local communities who supply the services.

7.11 NOISE

This section addresses potential noise effects of OCS development. It is important to note that a noise impact requires not only a significant noise source but a noise receptor as well. Since noise is attenuated with distance, a person must be close enough to the source to be subject to significant noise levels for an impact to occur. This distance depends on noise source and terrain; thus, it must be modeled on a case-by-case basis.

Significance Levels

Various federal, state, and local laws and guidelines specify acceptable noise levels for various receptors and land uses. In general, noise levels less than 40 decibels (dB) are not considered significant; however, even low levels of noise can be annoying to people when the background ambient noise is low. Changes in the character of sound can be detected when the sound spectrum of a noise source is different from the background sound spectrum. For example, the sound of a boat or offshore facility may be heard as distinct from the sound of waves on the beach even though the offshore noise is not very loud.

The impact methodology used here involves the use of A-weighted sound level (dBA), the measurement scale used in community noise level evaluation. The A-weighted sound level

corresponds to the relative annoyance to the human senses of noise experienced at various frequencies. Other factors include the time of day a noise occurs, the duration of the sound, background noise levels, as well as the sensitivity and proximity of receptors such as residences or schools. A project is generally considered to cause a noise impact if it causes an increase in the ambient A-weighted noise level of 3 or more decibels.

The Shell Hercules Draft EIR/S (SBC 1988) identifies three measures for determining the significance of a noise impact:

- An impact is significant if it will cause the Community Noise Equivalent Level (CNEL) to exceed 65 dB at a noise-sensitive location. CNEL is very similar to day-night weighted noise level (Ldn).
- An impact is significant if it will result in an incremental hourly energy equivalent sound level increase in the ambient noise which exceeds 9 dB. This criterion is applied to noise-sensitive locations where ambient levels with the added project noise would be less than a CNEL of 65 dB level.
- An impact is significant if the noise of an aircraft-related single event noise exposure level (SENEL) exceeds 88 dBA when measured at a noise sensitive location.

The Shell Hercules Draft EIR/S (SBC 1988) identified possible noise sources associated with offshore oil development. Listed in Table 7-4 are noise levels associated with platforms, onshore facilities, and storage operations.

Noise

Exploration

Most offshore exploration activities would occur more than 3 miles offshore. Consequently, sensitive receptors would not be subject to increases in noise levels. Recent interest in the effects of noise on the well being and behavior of marine fish, mammals, and birds is currently being investigated by the MMS. Impacts from vessel traffic are discussed below. The Shell Hercules EIR/S identified impacts to whale migration as a potential result of offshore noise.

Table 7-4

**TYPICAL NOISE LEVELS GENERATED BY
PLATFORMS, ONSHORE FACILITIES, AND STORAGE OPERATIONS**

<u>Activity</u>	<u>Equipment Item/HP</u>	<u>Units Required</u>	<u>Noise Level at 50 feet dB(A)</u>		<u>Hourly Noise Level Total Operation at 50 feet</u>
			<u>Per Unit</u>	<u>Total Units</u>	
Platform Operation	Flares	2	60	63	
	Crane	4	65	71	
	Generators	3	65	71	
	Cementing unit	3	65	71	
	Pumps	4	65	70	
	Compressors	7	65	73	
Energy Equivalent Sound Level. Leq:					78 dB(A)
Onshore Facilities	Compressors/475	2	72	75	
	Compressors/3000	2	85	88	
	Oxidizer/300	2	75	78	
	Water Pumps, Diesel/250	2	65	68	
	Misc. Equipment/ 10 to 100	50	60	77	
Energy Equivalent Sound Level. Leq:					89 dB(A)
Oil Storage and Transfer	Shipping Pumps/500	3	68	73	
Energy Equivalent Sound Level. Leq:					73 dB(A)

Source: Santa Barbara County 1988.

Noise

Platform and Pipeline Construction, Drilling, and Production

The most intense offshore construction noise would be associated with the erection of the platform. Construction noise caused by material and personnel transportation, driving of piles, and blasting will create a short-term impact which could be annoying to people at nearby onshore areas. A significant construction noise impact will be associated with pipeline construction and staging area activity; the noise levels will be temporary in nature, but annoying to those near the construction area. Platform construction will occur 6 to 12 miles offshore, and most construction noise will be well below 30 decibels onshore (OSHA limits noise for workers at 90 decibels).

In the early stages of subsea pipeline installation, the major noise sources are barge propulsion engines, welding generators, and heavy equipment needed to move long lengths of pipeline sections. Noise associated with pipeline laying can be audible from shore, but is a temporary impact, and one that is reduced or eliminated as the pipe laying activity moves further from shore.

Platform operation noise, as listed in Table 7-4 is not anticipated to create significant impacts.

Noise

Crew and Supply Operations

Crew and supply boat noise will come closer to shore; when experienced onshore at a distance of about 2 miles, the boats generate a noise level of 36 to 42 dBA (SBC 1988). The drone of a supply or crew boat could be noticeable in quiet areas, such as rural lands.

Aircraft operations associated with the project would involve inspection flights over the pipeline and helicopter operations for transport of personnel or equipment to the platforms. Each helicopter flyover can produce levels in the 75 to

88 dBA range at a distance of 500 feet, resulting in a significant noise impact.

During platform operation, two round-trip helicopter flights per day would result in noise levels of 75-85 dBA, which would exceed prevalent ambient noise conditions along most of the coastline. Also, the nature of helicopter bladeslap noise is unusual in most environments. High peak levels could result in annoyance and potential sleep interference. Impacts can be mitigated by planning flight routes to avoid populated areas and other sensitive receptors.

Tankers may generate as much as 80 dBA at 50 feet offshore. The estimated noise level at shore from a SALM located 4500 feet offshore with distance attenuation is 40 dBA. Because noise impacts decrease with distance from the noise source, a facility located a substantial distance offshore has less noise impact than an onshore facility in relatively developed areas.

Noise

Onshore Facilities

As a result of onshore construction activities, temporary noise impacts may occur to nearby residents and others using the area. Construction noise includes motor vehicle traffic, as well as actual facility grading and construction. Construction activities can generate noise levels of 75 dBA and greater at a distance of 300 feet, which could cause significant noise intrusions, depending on the proximity of residences to the site. Noise levels of 65 dBA can interfere with speech communication and cause high annoyance if they persist for long time periods.

Onshore oil facilities generate noise from personnel traffic, processing equipment, pumping equipment, and miscellaneous onsite sources. Heaters can produce 80 dBA at 30 feet, and compressors can produce 86 dBA at 15 feet.

Pumps in the 200 to 450 HP range can produce levels of 79 to 87 dBA at 15 feet.

Noise

Onshore Pipelines

Temporary noise impacts to nearby residents and others using the area can occur during pipeline construction. A typical active pipeline construction zone is approximately 3000 feet long and 100 feet wide at any one time. This zone progresses along the right-of-way at a rate of approximately one quarter mile per day. Assuming the use of 25 pieces of heavy equipment and 20 large welding generators along this zone, overall noise levels would range from 77 to 89 dBA at a distance of 50 feet, averaging around 86 dBA. Noise impacts associated with onshore pipeline construction are short term, with significant increases in noise levels lasting for 1 week or less at any given location as the pipeline construction progresses.

Pump stations may generate noise impacts if they are located in proximity to residences. In addition, maintenance and inspection vehicles could generate minor local increases in local traffic noise, and occasional inspection flights could produce temporary, short-term noise impacts.

7.12 SOLID AND HAZARDOUS WASTE

This section discusses solid or hazardous wastes that could be expected to require disposal in a landfill or hazardous waste facility. Potentially hazardous compounds that are emitted in other media (e.g., pollutants emitted into the air) or solids discharged into the ocean as part of a permitted discharge, are not included.

Solid and Hazardous Waste

Exploration and Platform Drilling

Drilling results in the generation of waste drilling muds and cuttings. Muds and cuttings generation depends on the depth and characteristics of the well. Mud recycling minimizes mud production and avoids continuous discharge

requirements. Historically these heavy solids are discharged overboard in compliance with NPDES permit requirements as enforced by the EPA. Recently, however, concern has been raised that such discharge may have an adverse water quality effect and that the discharge may not meet more restrictive ocean plan limitations currently being proposed. This prompted Santa Barbara County to recommend possible barging of Shell Hercules muds and cuttings to shore for disposal at a landfill (SBC 1988).

Additional solid and hazardous wastes associated with drilling include small amounts of contaminated muds requiring disposal as a hazardous waste, approximately 1000 pounds of trash per day per platform, and miscellaneous small quantities of waste solvents, water treatment chemicals, and pollution control waste streams (e.g., sulfur removal system slurries) (SBC 1988).

Table 3-3 lists typical solid wastes generated by offshore oil and gas development activities.

Solid and Hazardous Waste

Oil and Gas Processing

Oil and gas processing can result in similar spent chemicals and trash. Additionally, treatment processes, especially sulfur removal, can result in the generation of solid byproducts such as elemental sulfur. Oil companies generally consider these byproducts as saleable materials; they generally do not become wastes. If the byproducts become contaminated or impure, or if they were to be no longer marketable, the byproducts would require disposal. Determination of the wastes' hazardous properties must be made on a case-by-case basis; some wastes would likely be considered hazardous and would need to be disposed of accordingly.

7.13 CULTURAL RESOURCES

Cultural resources are places or objects that are important for scientific, historical, and religious reasons to a culture, community, group, or individual. Cultural resources that may be impacted by oil and gas development include archaeological sites and other artifacts, Native American cultural values, architectural remains, and shipwrecks.

Local Native Americans have a desire to protect sites which contain deposits from prehistoric or historic native occupations or use. Archaeological sites, as part of the Native American heritage, require that the integrity of human burials and their associated artifacts be respected. Burials are of great religious and spiritual significance to Native Americans along with sacred sites such as mountain tops, caves, springs, and sites associated with supernatural power. Native plants and animals, wetland areas, and remaining relatively pristine land areas are also significant to Native Americans.

The coastal lands contain abundant numbers of archaeological sites, most of which represent Native American resources. Table 7-5 shows the number of area sites listed on the National Register of Historic Places, as well as other known archaeological and historic sites in the project area (BLM 1980). It is highly likely that there are hundreds of other sites that have not been discovered and recorded due to lack of surveys.

Table 7-5
CULTURAL RESOURCE SITES IN THE STUDY AREA

<u>County</u>	<u>Sites on the National Register of Historic Places</u>	<u>Historic Sites</u>	<u>Archaeological Sites</u>
Sonoma	21	34	959
Marin	14	78	456
San Francisco	54	141	36
San Mateo	20	75	152
Santa Cruz	11	110	134
Monterey	34	100	390

Source: BLM 1980

Most cultural resource impacts occur as a result of ground disturbance and, therefore, occur during construction rather than operation of the project. If resources discovered during preconstruction site survey or during construction have no formal significance, there is no

requirement to preserve them. If, however, the resources are determined to be of local, regional, or national significance, they will be required to be recovered through excavation or other documentation programs prior to continuation of construction activity.

Onshore projects can also indirectly impact cultural resources. For example, run-off from an onshore facility may increase erosion, or may increase human access to a resource area resulting in increased surface collection, or an area used for sacred or religious purposes may be affected by project-related visual or noise impacts.

Offshore cultural resources may include submerged prehistoric sites, artifacts, and historic shipwrecks. Offshore prehistoric resources are rare, usually they have been displaced from their place of original use and deposition. Most shipwreck locations in shallow water are generally known to sport and commercial salvage divers, making it unlikely that unauthorized pilferage would be initiated by the proposed oil and gas development activities. If offshore cultural resources are suspected to exist on a particular lease, a cultural resource survey of that lease may be required.

Cultural Resources

Exploration

Geophysical investigations used to identify seafloor anomalies prior to exploratory drilling may actually lead to the identification of submerged historical or archaeological resources.

Cultural Resources

Offshore Development

Offshore oil and gas development activities such as ship anchoring, drilling, pipeline dredging, offshore construction, and nearshore construction can disrupt bottom sediments which may in turn damage offshore cultural resources. In addition, the placement of ferromagnetic materials on the seafloor may have an indirect impact on some cultural resources. Such materials can alter the magnetic properties of undiscovered cultural resources. Since remote sensing techniques used in locating submerged artifacts rely on their magnetic properties, any alteration reduces the likelihood of their being discovered and preserved.

Cultural Resources

Onshore Facilities

Land disturbance is inherent in construction of onshore facilities related to offshore oil and gas development. Construction of these onshore facilities may impact onshore archaeological, architectural, or historical sites and prehistoric, historic, or cultural Native American resources and values. The destruction or damage of buried cultural deposits as well as the interruption of sacred areas may occur through the introduction of industrial construction and traffic. Activities that can damage or destroy sites or artifacts include right-of-way clearing, grading, trenching and pipelaying, heavy equipment traffic, backfilling trenches, and regrading. Besides causing physical destruction of artifacts, these activities can result in reduction or loss of the research value of a site because important archaeological data are derived from the vertical spatial relationships of artifacts and other site features. Construction workers or other members of the public can also impact resources by collecting artifacts that may be essential to archaeological reconstruction of history or prehistory. During operation of onshore facilities, an oil spill may contaminate the contents of archaeological sites and disturb large areas, including unsurveyed areas.

7.14 ONSHORE WATER RESOURCES

Onshore water resource impacts considered here include both surface water and groundwater impacts. Important surface water resources include wetlands and estuaries such as Elkhorn Slough in Monterey County. Estuaries form where rivers enter the sea. Streams and the surrounding habitat support numerous animals species including many varied types and numbers of birds. In addition, groundwater is an essential resource which must be managed and protected.

Surface water impacts consist of erosion and sedimentation, runoff, flooding, and general water quality degradation. Runoff and rainfall-related erosion characteristics can change as

a result of project development. Various laws and regulations govern surface water impacts including local policies to address cut-and-fill operations; Coastal Act policies which address minimization of flood hazards, minimization of erosion, and maintenance of biological productivity of streams; Regional Water Quality Control Board (RWQCB) regulations of surface water discharges; and California Department of Fish and Game requirements for a stream alteration agreement for any activity which will substantially alter the flow of a stream.

Groundwater impacts consist of water level drawdowns as a result of groundwater production, groundwater production relative to safe yield of aquifers, and potential water quality degradation resulting from spills and leaks of contaminants. Project activities which preempt, preclude, or severely limit existing or potential uses of the groundwater resource are considered major issues. The various regulations which govern groundwater impacts include Coastal Act policies which require that groundwater development not interfere with surface water flow or the productivity of streams, local policies which protect the quantity and quality of resources, RWQCB policies regarding beneficial uses and quality of groundwater, and EPA primary and secondary drinking water standards which apply to groundwater.

Onshore Water Resources

Offshore Development

The demand for fresh water for offshore activities such as oil and gas exploration, development, and production will impact onshore water resources since water supply will come from the local counties. See Table 3-4 for offshore water use requirements.

Onshore Water Resources

Onshore Facilities'

Construction

Construction of onshore facilities, including oil and gas processing facilities and onshore pipelines, includes several activities that can affect local surface waters. Primary activities of potential concern include clearing, grading, and filling activities which can result in increased erosion and sedimentation. If pipeline construction occurs during a period of heavy rainfall, sediment can be transported along the pipeline right-of-way. Oil spills during the construction

phase could be significant if any contaminants infiltrate soils or run off into streams.

Groundwater impacts during the construction phase result from fresh water needs for hydrostatic testing of pipelines, dust suppression, and work force needs. Fewer water impacts are anticipated during construction than during operation. Water for construction and operation will most likely be purchased from commercial suppliers.

Onshore Water Resources

Onshore Facilities' Operation

Surface water impacts during the operational phase will be similar to the construction phase. The most important impacts would include degradation of surface water quality due to spills and leaks from accidents, pipeline breaks, storage tank ruptures, and increased erosion with resulting sedimentation. The greatest potential impact would be degradation of surface water and soil resulting from a catastrophic failure of pipelines or storage tanks, as might occur during a major earthquake.

The major impacts on groundwater resources would result from the use of groundwater for project water supplies. Water level drawdown could occur at onsite as well as offsite wells. Water is needed for irrigation, fire safety systems, personnel needs, and oil and gas processing during operation (see Table 3-4 for water use volumes). If the water needs are met by groundwater supplies, a major significant impact could result for project- related water supply.

Groundwater resources could be subject to salt water intrusion due to water level drawdown, and to contamination from leaking tanks. Both of these effects could create significant adverse impacts.

7.15 TERRESTRIAL ECOLOGY

This section provides a brief overview of onshore biological resources in the study area, followed by a discussion of the impacts which may result from offshore oil and gas related facilities and activities.

The rugged central California coastline is characterized by open marine terraces, coastal bluffs, coastal beach and dunes, coastal mountains, streams, and coastal wetlands. Regional plant communities include coastal and beach dune, native grassland, coastal scrub, coastal salt marshes, as well as agricultural and other disturbed lands. These communities support a diverse array of birds, mammals, and reptiles. Selected species of interest in the study area include brown pelicans, osprey, cormorants, deer, gray fox, elk, bobcats and mountain lions. Major wetlands along the coast include Bodega Bay, Bolinas Lagoon, San Francisco Bay and estuary, Elkhorn Slough, and Pescadero Marsh. The endangered California clapper rail, least tern, black rail and Brown Pelican are all residents of the Elkhorn Slough and the California black rail, a threatened marsh bird, inhabits the Pescadero Marsh.

Construction activities, normal operation, and accidents associated with offshore development may result in significant impacts, including removal or destruction of biologically important or rare habitats and species. Level of impact varies depending on the relative sensitivity of the habitat or the species affected by the projects. Potential impacts are identified for relevant activities below.

Terrestrial Ecology

Exploration

Seismic surveys and exploration drilling do not usually impact terrestrial ecology. It is expected that onshore support services will be provided by existing facilities. However, if expansion were required, impacts to terrestrial ecology would be similar to those discussed below for onshore development.

If an oil spill occurs from exploratory drilling operations, the regionally sensitive habitats in the region such as the Elkhorn Slough and Pescadero Marsh, as well as endangered and threatened species, could be impacted.

Construction and operation of offshore facilities (platforms, pipelines, OS&Ts) does not typically impact terrestrial ecological resources. Offshore pipeline construction can require a cleared staging area of 1 to 5 acres; impacts from clearing a staging area would be similar to impacts from construction of onshore facilities discussed below.

Development drilling and production could result in an offshore oil spill, which could have a significant impact on sensitive coastal habitats such as estuaries and marshes, and their rare and endangered inhabitants.

Terrestrial Ecology

Onshore Facilities' Construction

Construction of onshore oil and gas treatment facilities, tank farms, crew and supply bases, and marine terminals result in permanent destruction of onshore habitat. The significance of the impacts depends on the exact location and size of the facility (see Table 3-5) and the sensitive resources and specific species of special interest in the area. The principle impacts from construction are related to vegetation removal, dust generation, erosion sediment deposition, and establishment of aggressive weeds that invade into adjacent native vegetation.

During the construction phase, clearing of vegetation at onshore facilities and along pipeline corridors can result in loss or degradation of vegetation; rare, threatened, or endangered species; and wildlife habitat. Consequent erosion could impact vegetation, wildlife, and aquatic habitats. Impacts could range from short term for areas that recover rapidly to long term for areas occupied by processing facilities or for areas that recover slowly from disturbance (SBC 1988). Impacts on woodlands would be significant due to the long time required for recovery and due to the fact that pipeline operations would not permit trees in

the right-of-way. Noise, dust, and visual disturbance from construction could affect wildlife in nearby habitats by interfering with breeding or foraging activities, altering movement patterns or causing avoidance (usually temporary) of the area (SBC 1988).

The long-term impacts of pipeline operation depend on the degree to which habitat is altered by the corridor. A pipeline could affect the number, distribution, and viability of threatened, endangered, or rare plant or animal species. If a corridor crosses a creek or river, construction activities can damage habitat and biota.

Onshore pipelines typically require a 50-to 100-foot right-of-way which is disturbed during construction activities. Plant communities disturbed can usually be replanted after construction; therefore, impacts to vegetation are short-term and not significant (SBC 1988). In steep areas, erosion resulting from construction could cause a significant impact. Regrowth of trees is not allowed on the permanent operational right-of-way (usually 25 feet), thus construction of a pipeline through a stand of trees could result in a significant long-term impact.

Terrestrial Ecology

Onshore Facilities' Operation

The impacts of operating onshore facilities relate to the associated noise, traffic, lighting, increased human activity, facility emissions, ground-water withdrawal, and altered surface runoff (SBC 1988). Some wildlife species are likely to avoid or abandon previously occupied areas resulting in an altered animal community. Facility emissions could impact plants through direct toxicity or through physiological stress (SBC 1988).

Terrestrial Ecology

Operational Oil Spills

Onshore oil spills from a processing facility failure, ruptured pipeline, marine terminal accident, or fire, could have a significant local impact on vegetation, wildlife, and aquatic species. Of particular concern would be impacts to sensitive habitats and to the threatened or endangered species in the study area. A LPG/NGL truck accident could also impact sensitive biological habitats in the area.

Terrestrial Ecology

Onshore Facilities'

Abandonment

Abandonment of onshore facilities is assumed to include removal of all structures, replacement of top soil, and revegetation of the site. Abandonment activities would cause a short-term disturbance to vegetation adjacent to the facilities during foundation removal and site contouring; noise and human presence would likely cause animals to avoid the area (SBC 1988). The long-term success of restoring vegetation and wildlife will depend upon the success of reestablishing native plant species on the site. Onshore pipelines would be cleaned and abandoned in place, unless regulations at the time require removal. Abandonment of pipelines in place would have no impact on biological resources.

7.16 GEOLOGY

Geology has both the potential to affect and be affected by project development. Earthquake, differential settlement, slope failure (even on slopes as gentle as 0.25°), cliff retreat, liquefaction, and slumping are examples of geologic hazards which can occur on or offshore in the study area. These geologic hazards can cause severe impacts to offshore oil and gas related facilities, which in turn may cause severe secondary impacts. For example, if an earthquake with significant ground motion occurs and ruptures a pipeline, it may cause the secondary impact of an oil spill. The geologic impact is the pipeline rupture. The related environmental impact is the oil spill which undoubtedly would not have occurred without the oil and gas facilities in place. (Causes of oil spills are discussed in Section 7.2,

Systems Safety, of this report. Effects of oil spills are discussed in the individual sections of this chapter relating to specific environmental impact areas.)

Earthquakes occur along faults although their effects may be felt for hundreds of miles. The San Andreas Fault, the major fault in the study area, is a zone laced with many smaller faults stretching from Humboldt County southeast for about 650 miles to Imperial County. The fault essentially runs parallel along the California coast, creating obvious central coast features such as the submerged valleys of Bodega Bay and Tomales Bay. Movement along the fault can be immense. For example, the 1906 San Francisco earthquake ruptured the fault surface for 200 miles and caused 20 feet of slippage at the north end of Tomales Bay. Such catastrophic geologic events would cause significant secondary environmental impacts to offshore oil and gas related facilities. (Please refer to Section 7.2, Systems Safety, of this report for specifics.)

Facility development may also induce certain localized impacts to area geology in the project vicinity. Construction activities such as vegetation removal, trenching, impoundment construction, or cut and fill activities may lead to impacts to an area's geology such as landslides, slumping, or erosion.

Geology

Offshore Development and Onshore Facilities

Geologic effects on all oil and gas related structures pose a threat of oil spills and related dangers such as fire, H₂S emergencies, or explosions. Worker safety and public safety are at risk in these events, along with potential environmental damage. Examples of geologic actions which can cause significant damage to offshore facilities include:

- earthquakes - direct damage from groundshaking, tsunami, and/or induced ground instability
- ground instability - due to earthquakes, wave action, or gravity alone, can cause mass movement such as landslides, slumps, flows, creep, or cliff retreat.

- offshore - shallow gas and gas-charged sediments can cause sediment instability as described above. If deep gas, may cause blowouts along drill stems.

Effects on local geology are due to alteration of local topography brought on primarily through facility construction. Erosion, landslides, sedimentation, and induced slumping (e.g., through rapid water drawdown) are possible project development effects due to vegetation removal, trenching, foundation or impoundment excavation and construction, cut and fill, or incomplete compaction of soils. Offshore construction effects on geology include altered sediment transport, induced scour (especially at pipeline landfalls), anchor scarring, and induced slumping due to removal of hydrocarbon resources.

Site specific geologic investigations will reveal major sources of geologic concern. These concerns must be reflected in facility siting, design, and engineering to ensure adequate minimization of potential danger. It must be noted that this danger can never be eliminated.



CHAPTER 8

CHAPTER 8

COUNTY CONCERNS

8.1 INTRODUCTION

This chapter identifies potential environmental impacts that could occur in each central coast county from OCS oil and gas activities under normal operating conditions. Based on generic baseline conditions in the study area, development scenarios outlined in Chapter 5, impacts identified in Chapter 7, and ERCE's knowledge and experience with offshore oil and gas development projects, key potential impacts for each county were identified. Table 8-1 summarizes by county, oil and gas development facilities and activities which are anticipated to occur in the vicinity, while Table 8-2 summarizes by county associated potential environmental impact areas from these facilities and activities. Impact potentials listed in Table 8-2 were classified into three categories:

- Impacts expected to be potentially significant;
- Impacts expected to be of moderate potential consequence; and
- Impacts expected to be of minimal potential consequence.

Potential impacts which are expected to be highly localized or specific to one area are identified, and areas where there is insufficient data available or where impacts are very site specific are noted.

8.2 ASSUMPTIONS

Several important assumptions were incorporated into this analysis. They include:

1. The analysis assumes normal federal, state, and county procedures, permit requirements, and mitigation measures are implemented, such as NPDES permits;
2. The impact analysis only considers the anticipated facilities and activities identified on Table 8-1 for each county.

**TABLE 8 - 1 Summary of Potential Oil Facilities and Activities for Each
Oil Transportation Option for Central Coast Counties: Base and High-Case Scenarios**

OCS DEVELOPMENT FACILITIES

OIL TRANSPORTATION OPTIONS	FACILITIES OPTIONS		SCENARIO I, BASE CASE								SCENARIO II, HIGH CASE								
			PLATFORMS	OS&T	OFFSHORE PIPELINES	MARINE TERMINAL	TANKER TRAFFIC	CREW AND SUPPLY BOAT TRAFFIC	ONSHORE OIL AND GAS PROCESSING	ONSHORE GAS PROCESSING	ONSHORE PIPELINE CORRIDOR	PLATFORMS	OS&T	OFFSHORE PIPELINES	MARINE TERMINAL	TANKER TRAFFIC	CREW AND SUPPLY BOAT TRAFFIC	ONSHORE OIL AND GAS PROCESSING	ONSHORE GAS PROCESSING
SONOMA																			
	ONSHORE PIPELINE	2		4-6			Yes	2		2	3		6-9			Yes	3		3
	OS&T	2	2	2		Yes	Yes		2	2	3	3	3		Yes	Yes		3	3
	MARINE TERMINAL	2		4-6	1	Yes	Yes	2			3		6-9	1	Yes	Yes	3		
MARIN																			
	ONSHORE PIPELINE						?									?			
	OS&T					Yes	?								Yes	?			
	MARINE TERMINAL					Yes	?								Yes	?			
SAN FRANCISCO																			
	ONSHORE PIPELINE						?									?			
	OS&T					Yes	?								Yes	?			
	MARINE TERMINAL					Yes	?								Yes	?			
SAN MATEO/ SANTA CRUZ																			
	ONSHORE PIPELINE	3		2-3			Yes	1		1	5		4-6			Yes	2		2
	OS&T	3	1	1		Yes	Yes		1	1	5	2	2		Yes	Yes		1	2
	MARINE TERMINAL	3		2-3	1	Yes	Yes	1			5		4-6	1	Yes	Yes	2		
MONTEREY																			
	ONSHORE PIPELINE						?									?			
	OS&T					Yes	?								Yes	?			
	MARINE TERMINAL					Yes	?								Yes	?			

LEGEND	
NO PROJECT FACILITY/ACTIVITY ANTICIPATED	?
3 INDICATES THE NUMBER OF OIL-RELATED FACILITIES	INDICATES COUNTIES WHICH MIGHT HAVE CREW AND SUPPLY BOAT TRAFFIC DEPENDING ON THE FINAL LOCATION OF CREW AND SUPPLY BASES
Yes INDICATES TANKER TRAFFIC AND/OR CREW AND SUPPLY BOAT TRAFFIC	

**TABLE 8-2 Potential Environmental Impacts by County from OCS Oil and Gas Activities
(Based on ERCE Development Scenarios)**

ENVIRONMENTAL ISSUE AREA COUNTY	AIR QUALITY (1)	MARINE WATER RESOURCES (1)	MARINE BIOLOGY (1)	COMMERCIAL FISHING (1)	VISUAL RESOURCES	LAND USE	RECREATION AND TOURISM (1)	ONSHORE TRAFFIC	MARINE TRAFFIC (1)	SOCIOECONOMICS	NOISE	SOLID WASTE	ONSHORE WATER RESOURCES (1)	CULTURAL RESOURCES (1)	TERRESTRIAL ECOLOGY (1)	GEOLOGY
SONOMA	●●	●	●●	●●	●●	●●	●●	●●	●●	●	●●*	●*	●●	●*	●*	●*
MARIN	●	●	●●	●	●*	●	●	●	●	●						
SAN FRANCISCO	●	●	●●	●		●	●	●	●●							
SAN MATEO	●●	●	●●	●●	●●	●●	●●	●●	●●	●	●*	●*	●●	●*	●*	●*
SANTA CRUZ	●●	●	●●	●●	●●	●●	●●	●●	●●	●	●*	●*	●●	●*	●*	●*
MONTEREY	●	●	●●	●			●		●							

1) Impacts are identified based on worst-case operating conditions. These environmental issue areas could be greatly impacted during a catastrophic event (e.g., oil spill, H₂S emergency).

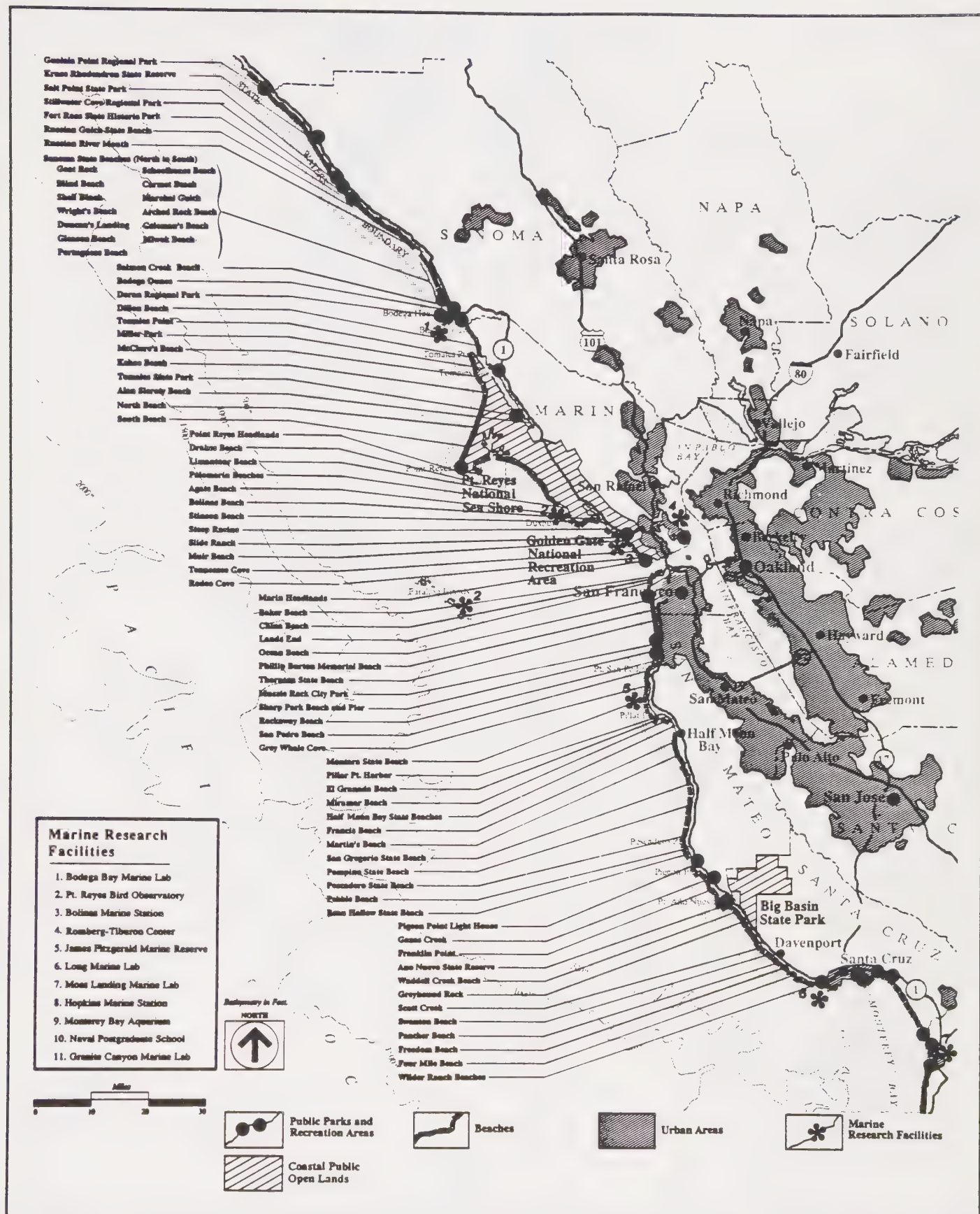
LEGEND	
●●	POTENTIAL SIGNIFICANT IMPACT
●	POTENTIAL IMPACT
	MINIMAL POTENTIAL IMPACT
●*	HIGHLY LOCALIZED IMPACT

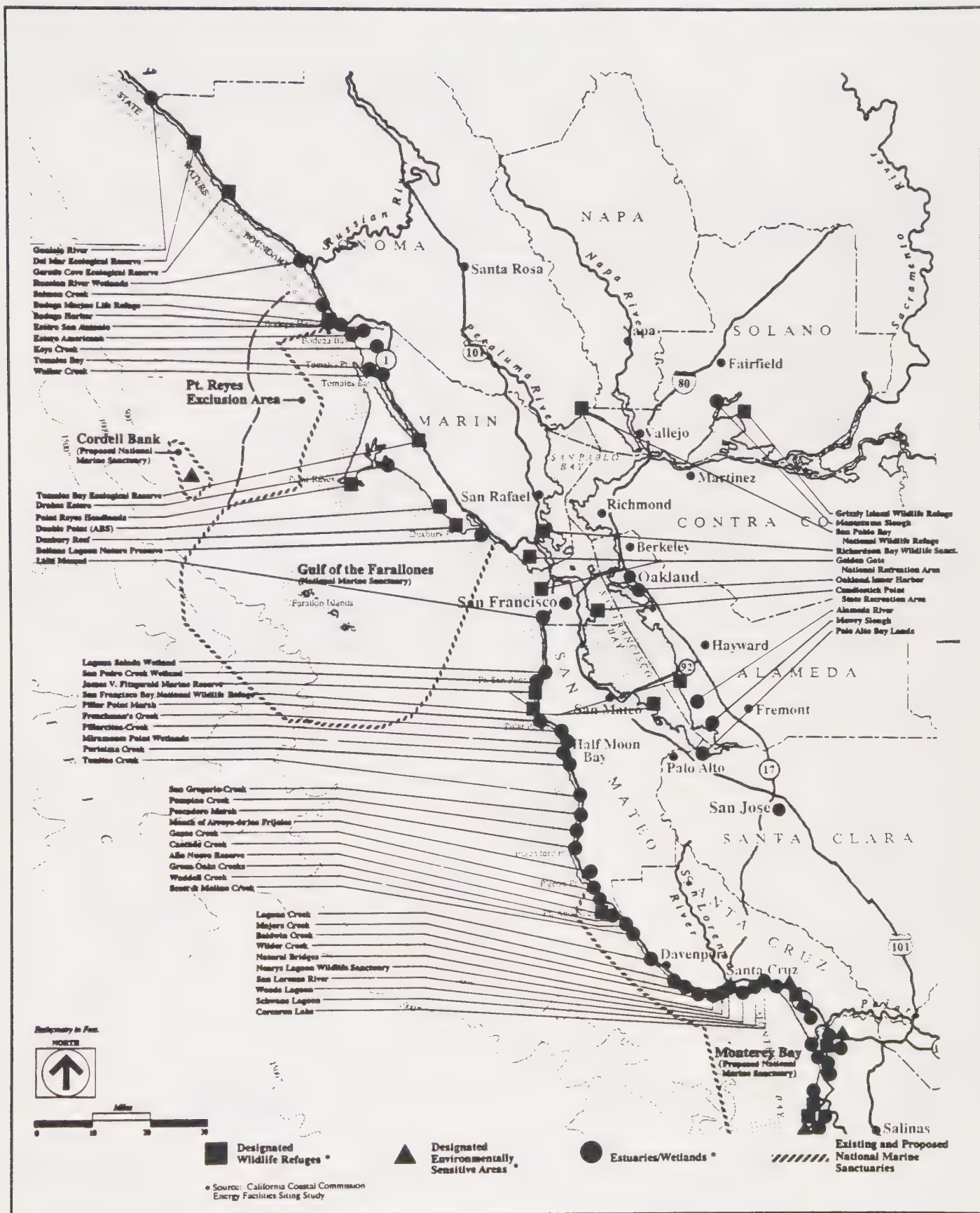
3. The analysis identifies impacts associated with the normal construction and operation of facilities; and
4. If a catastrophic event were to occur and result in a major oil spill, marine water resources, marine biology, commercial fishing, recreation and tourism, marine traffic, onshore water resources, cultural resources, and terrestrial biology could all be seriously impacted. Depending on the size of the spill and effectiveness of clean-up, residual impacts could occur such as socioeconomic impacts from a reduction in tourism.

8.3 COUNTY CONCERNS

This analysis relies heavily upon general baseline information available for the study area. The coastal land uses and natural resources in central California are identified in Figures 8-1a, 8-1b, 8-2a and 8-2b. Based on available information, these maps identify key coastal land uses, including parks and recreational areas and identify sensitive natural resources such as bays, estuaries, and Areas of Special Biological Significance (ASBS). Appendix B provides an in-depth discussion of the coastal land use conditions and policies of each county. The scenario development maps presented in Chapter 5 were also utilized; however, this impact analysis focuses on the potential impacts which could occur from offshore development in general. Please refer to Chapter 7 for a discussion of impacts associated with a specific offshore oil and gas development activity.

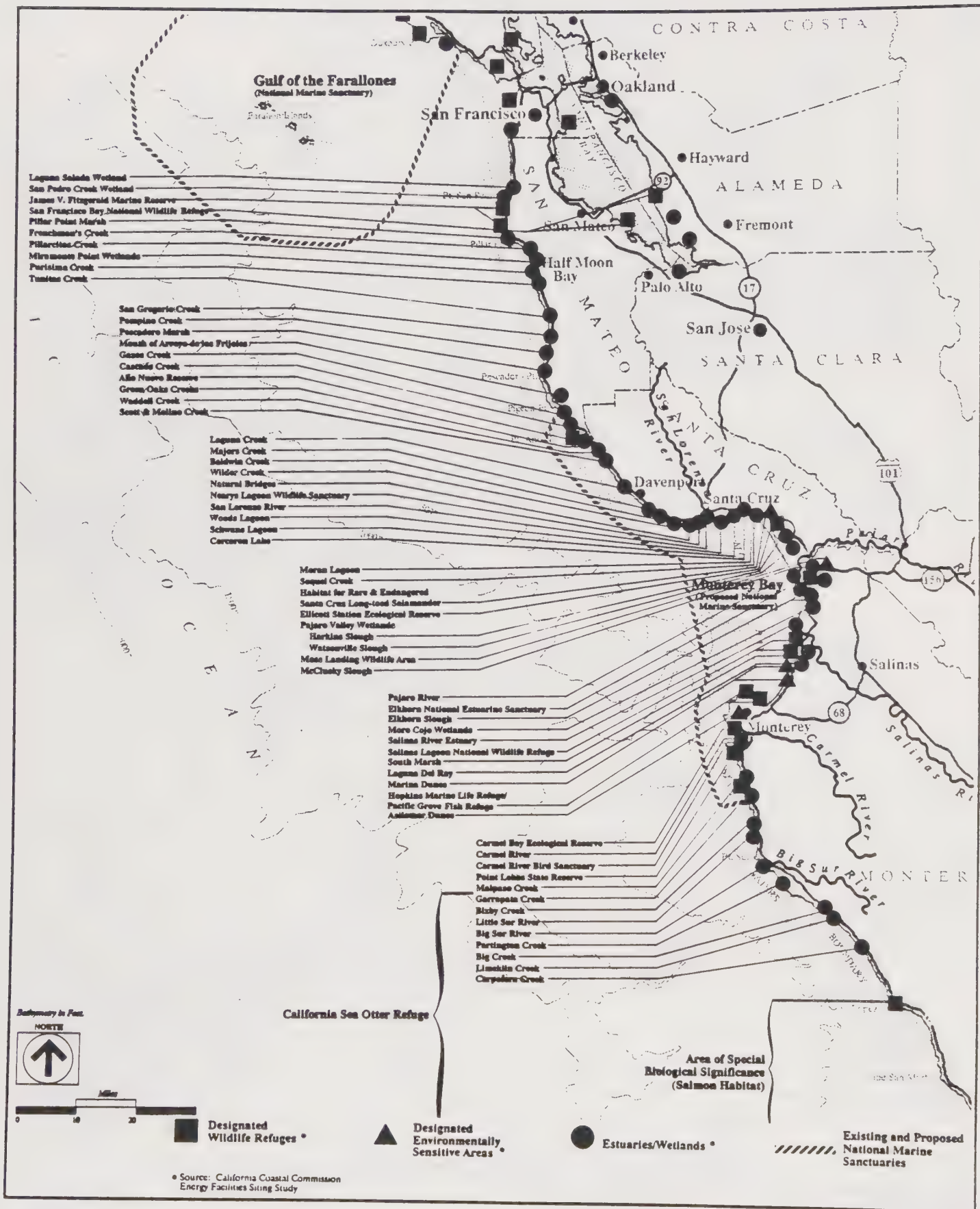
It is impossible at this stage to determine the configuration a specific offshore development project might actually take, however, as discussed in detail in Chapter 5, general assumptions on project components have been made. Table 8-1 summarizes the project facilities and activities expected to be in the general vicinity of each county for the base-case and high-case scenarios. Based on the development scenarios outlined in Chapter 5, one can expect to see two to three platforms off of Sonoma County and three to five platforms off of San Mateo and Santa Cruz counties. The exact location of crew and supply bases is uncertain at this time; however, crew and supply boats will service the platforms. Three transportation options were developed in Chapter 5: the onshore pipeline transportation option, the OS&T option, and the marine terminal option. Onshore pipelines would connect onshore processing facilities to the San Francisco Bay area refineries. Pipeline





FIGURE

8-2A



corridors would cross Sonoma and possibly Marin counties on the north, and Santa Cruz and San Mateo counties on the south. For the onshore processing options, two to three onshore processing facilities would be required in Sonoma County, with one to two onshore processing facilities in San Mateo and Santa Cruz counties. Under the OS&T transportation option, two to three OS&Ts would be located off of Sonoma County and one to two off of San Mateo and Santa Cruz Counties, each with associated tanker traffic. Under the marine terminal option, one marine terminal could be required in Sonoma County and one in San Mateo or Santa Cruz counties; each with associated tanker traffic. Under these options, tanker traffic travelling north and south will potentially occur off of all the counties. If the crude is taken to the San Francisco Bay Area for refining, tankers or barges will travel through the San Francisco Bay. If crude is shipped to Los Angeles or the Gulf, tankers would travel south past Monterey County.

Table 8-2 identifies the potential impacts expected to occur to each central coast county from OCS development in general. Because most of the development is expected to occur off of Sonoma, San Mateo, and Santa Cruz counties, the majority of the major potential impacts are expected off these counties. Under these scenarios, impacts to Marin, San Francisco, and Monterey counties would occur mainly from vessel traffic, crew and supply boat traffic, air pollution, or a major oil spill.

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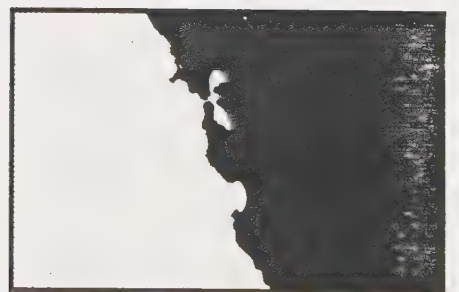
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APPENDIX A

APPENDIX A

OVERVIEW OF OFFSHORE OIL AND GAS DEVELOPMENT REGULATIONS AND PERMITS

A.1 OVERVIEW

Numerous federal, state, and local regulations and agencies influence offshore oil and gas development (see Table A-1). Management of offshore resources is divided among federal, state, and local jurisdictions and is also split among several different federal, state, and local agencies, each with its own management responsibilities. In the case of offshore oil and gas resources, the federal government controls development in the ocean area extending from 3 to 200 miles offshore, the state government generally controls the ocean belt from the shoreline to 3 miles offshore, and local governments have permitting authority over development facilities located onshore and over air quality onshore and in the ocean area out to 3 miles.

The coastal zone is defined as land and water extending seaward to the state's outer limit of jurisdiction (generally 3 miles from the mean high tide line), including offshore islands, and extending inland generally 1000 yards from the mean high tide line of the sea. In significant coastal estuarine habitat and recreational areas it extends inland to the first major ridgeline paralleling the sea or 5 miles from the mean high tide line of the sea, whichever is less. In developed urban areas the zone generally extends inland less than 1000 yards. The coastal zone does not include the area of jurisdiction of the San Francisco Bay Conservation and Development Commission.

Local governments with a certified Local Coastal Program (LCP) have permit authority in the onshore coastal zone areas subject to the CCC's review of appeals (all six central coast counties have approved LCPs). For each jurisdiction, the relevant regulations and agencies are summarized on Table A-1 and discussed below.

A.2 FEDERAL REGULATIONS AND AGENCIES

At the federal level, the major law regulating offshore oil development is the Outer Continental Shelf Lands Act Amendments (OCSLAA) of 1978, which amended the 1953

Table A-1

**MAJOR AGENCIES, LAWS AND PERMITS AFFECTING
OFFSHORE OIL DEVELOPMENT**

<u>Agency</u>	<u>Law</u>	<u>Permit</u>
Federal: Minerals Management Service	Outer Continental Shelf Lands Act Amendments (OCSLAA) 43 U.S.C. § 1331-1356	Permit to Drill
National Oceanic and Atmospheric Administration (NOAA)	Coastal Zone Management Act (CZMA) 16 U.S.C. § 1451-1464	Consistency Certification ^a
Environmental Protection Agency (EPA)	Clean Water Act 33 U.S.C. § 1251-1376	NPDES
Army Corps of Engineers (COE)	River and Harbor Act of 1899 33 U.S.C. § 401 et seq.	404 Permit, Section 10 Permit
U.S. Fish and Wildlife Service, National Marine Fisheries Service	Endangered Species Act 16 U.S.C. § 1531-1543	Section 7 Consultation
Applies to all Agencies	National Environmental Policy Act 42 U.S.C. 4371 et seq.	Environmental Impact Statement
State: California State Lands Commission	Submerged Lands Act 43 U.S.C. § 1301-1315	Right-Of-Way/Land Use Lease
California Regional Water Quality Control Board	Porter-Cologene Act Water Code, § 13000 et seq.	NPDES
California Department of Fish and Game	California Fish and Game Code § 1600-1607	Stream Alteration Permit
Department of Transportation (Caltrans)	Streets and Highway Code § 660-734	Encroachment Permit
Applies to all Agencies	California Environmental Quality Act (CEQA) PRC § 2100 et seq.	Environmental review process
California Coastal Commission (CCC) ^b	California Coastal Act PRC § 30000 et seq.	Coastal Development Permit
Air Resources Board	California Air Pollution Control Laws	

Table A-1 (Continued)

**MAJOR AGENCIES, LAWS AND PERMITS AFFECTING
OFFSHORE OIL DEVELOPMENT**

<u>Agency</u>	<u>Law</u>	<u>Permit</u>
Local: County/City governments (Planning Departments)	General Plans Zoning Ordinances Local Coastal Plans	Land Use Permit/Coastal Development Permit, Conditional Use Permit
Air Pollution Control Districts	Local rules and regulations	Authority to Construct, Permit to Operate (PTO)

-
- a. The office of Ocean and Coastal Resource Management (OCRM) within NOAA administers the CZMA for the Secretary of Commerce and publishes regulations which implement the act.
 - b. The CCC reviews federal permits for consistency with the federally approved California Coastal Management Program.

Outer Continental Shelf Lands Act (OCSLA). The major federal agency involved is the Department of the Interior's Minerals Management Service (MMS), whose primary function is to implement the OCSLAA and to manage the extensive government royalties derived from offshore oil development.

National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) sets out policies and goals for protection of the environment and requires the preparation of an Environmental Impact Statement (EIS) prior to major federal actions which could have a significant impact on the environment. Upon receipt of a complete POE or DPP, MMS conducts an environmental assessment (EA) which provides a brief analysis for determining whether or not an EIS should be prepared.

Outer Continental Shelf Lands Act Amendments

The Outer-Continental Shelf Lands Act Amendments establishes federal jurisdiction over the natural resources of the OCS and gives the Secretary of the Interior primary responsibility for managing OCS mineral exploration and development. The amendments also created a 5-year oil and gas leasing program and provided for state and local government involvement in the leasing process.

The OCSLA established three major goals for the comprehensive management of ocean minerals: 1) to ensure orderly and timely development of mineral resources to meet the energy demands of the nation; 2) to provide for protection of the environment concomitant with mineral resource development; and 3) to provide for receipt of a fair market value for leased mineral resources.

In addition, to ensure that the secretary takes the views of all interested persons in account, the 1978 amendments provide for participation in the OCS process by Congress, affected state and local governments, relevant federal agencies, and the public (43 U.S.C. §1337-1353).

Coastal Zone Management Act

Several other federal laws play a significant role in regulating offshore oil development, including the Coastal Zone Management Act (CZMA). The CZMA is administered by the Department of Commerce, through the National Oceanic and Atmospheric Administration's (NOAA) Office of Ocean Coastal and Resource Management (OCRM). The CZMA provided financial incentives to the states to develop coastal zone management plans and, through the "consistency provisions" (Section 307), it provided that all federal actions which directly affect the coastal zone would have to be consistent with federally-approved state coastal plans. Thus, state coastal zone management agencies, such as the California Coastal Commission, acquired the right to review offshore development projects in federal waters for consistency with the approved state coastal management program. As of 1978, California had their coastal management program approved by OCRM.

In the case of offshore oil and gas development in federal waters, the consistency review process currently applies to exploration, development, and production activities, but not to a lease sale. The relevant section of the CZMA is Section 307(c)(3), which provides for consistency review for nongovernmental applicants for federal licenses or permits.¹ Under Section 307(c)(3), the commission's objection to an exploration or development and production plan precludes all federal agencies from issuing any permit or license necessary for the activity to proceed, unless the Secretary of Commerce finds that the activity objected to may be federally approved because "it is consistent with the objectives of the CZMA," or

¹ Section 307(c)(1): Section 307(c)(3)(1) requires that "each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent feasible, consistent with approved state management programs." Therefore, a federal activity must have a "direct effect" on the coastal zone for purposes of Section 307(c)(1).

The interpretation of the phrase "directly affecting the coastal zone" was the center of one past controversy. On January 11, 1984, the Supreme Court ruled in *Secretary of the Interior v. California*, that the sale of OCS oil and gas leases is not an activity "directly affecting" the coastal zone, within the meaning of Section 307(c)(1), and therefore a determination of consistency is not required before such a sale is made. The decision relies on an interpretation of the CZMA's original legislative history and the OCSLA amendments of 1978. As a result of this decision, Lease Sale 119 will not require a consistency determination from the CCC, reducing the state's role in the initial lease sale process.

Section 307(c)(3): In 1976, Congress increased the states' ability to influence OCS development activities by adding to the permit consistency provision a subparagraph dealing explicitly with OCS exploration, development, and production plans (16 U.S.C. § 1456(c)(3)(b)). In contrast to other relatively uncertain consistency review opportunities given to the states by Section 307(c)(1), Section 307(c)(3) applies to nongovernmental applicants for federal licenses or permits. The consistency process is a significant opportunity for local governments to become involved in the process and comment on OCS-related activities which will occur off their respective onshore areas.

is "otherwise necessary in the interest of national security." If either of these grounds are met, the secretary may sustain the appeal.²

Currently in Washington D.C., bills are in both the Senate and House of Representatives to amend the CZMA to restore consistency to the lease sale process. Bills S 1412 and HR 3202, if passed, would undo the Secretary of the Interior v. California ruling which said that OCS lease sales do not require a CZMA consistency assessment.³

Clean Water Act, National Pollutant Discharge Elimination System Permit

The Clean Water Act sets out two basic mechanisms for preventing and reducing water pollution: the regulation of discharges from point sources by the National Pollutant Discharge Elimination System (NPDES) and the regulation of discharges of oil and hazardous substances. Under the NPDES program, administered by the Environmental Protection Agency (EPA), a NPDES permit is required for discharges in federal waters. Within California state waters, EPA has delegated NPDES permitting authority to the State Regional Water Quality Control Board.

Army Corps of Engineers Section 404/Section 10 Permit

The U.S. Army Corps of Engineers (COE) has the responsibility to protect and develop the nation's water resources and to regulate construction in waters of the United States. The COE regulates discharge of dredged or fill materials, construction in navigable waters, and transport of dredged material for dumping into ocean waters. Construction of a platform, pipeline, or OST in navigable waters requires a Section 404/Section 10 permit.

² The regulations for interpreting the grounds for upholding a state's consistency objection are found at 15 CFR 930.121.

³ The Supreme Court ruled in Secretary of the Interior v. California that OCS oil and gas lease sales do not require a CZMA consistency assessment. In California v. Watt, the Ninth Circuit ruled that Section 307(c)(1) of the CZMA required the Secretary of Interior to determine whether OCS Lease Sale 53 was consistent with the California Coastal Zone Management Plan. On January 11, 1984, the Supreme Court reversed the Ninth Circuit's decision in Secretary of the Interior v. California. The facts and background of these cases are laid out in the District Court's opinion in California v. Watt (520 F. Supp. 1359, 1365-68[C.D. Cal. 1981]).

Section 7 Consultation

The Endangered Species Act provides protection for listed plants and animals in both federal and state jurisdictions. It also requires that federal agencies consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of endangered or threatened species, nor result in the destruction of critical habitat. This consultation is commonly called the "Section 7 Consultation".

Other Federal Regulations

The Clean Air Act (42 U.S.C. 7401 et seq.) sets general guidelines and minimal air quality standards on a nationwide basis in order to protect and enhance the quality of the nation's air resources. The Marine Mammal Protection Act of 1972 (16 U.S.C. § 136 et seq.) imposes a moratorium on harassment, hunting, capturing, or killing of marine mammals without a permit from either the Secretary of Interior or the Secretary of Commerce, depending upon the species of marine mammal involved.

A.3 STATE AGENCIES AND REGULATIONS

One major statute regulating offshore oil development in state waters is the Submerged Lands Act of 1953, which gave the states authority over resources in submerged lands from the shoreline to 3 miles offshore. The major state laws and agencies affecting offshore development are listed in Table A-1. The State of California has direct permit jurisdiction over activities which occur in the tidelands area between the mean high tide line and the 3-mile state territorial limit.

California Environmental Quality Act

The California Environmental Quality Act (CEQA), like NEPA, requires the preparation of Environmental Impact Reports (EIRs) to assess the environmental consequences of major public and private development actions. The Permit Streamlining Act aims at expediting the permit procedures for development projects by coordinating the environmental review processes of NEPA and CEQA, and mandating a 1-year deadline for approval or denial of a project after an application for a development project has been submitted and is deemed complete. However, this time limit has proved to be too short for major, controversial

offshore and onshore oil projects. The current process requires an extension of the 12-month CEQA process to 18 or 24 months.

State Lands Commission

The State Lands Commission (SLC) issues leases and permits for all activities occurring from the mean high tide line to 3 miles seaward. The SLC requires a pipeline right-of-way land use lease for pipelines which cross through state waters.

California Coastal Commission

The CCC, created under the California Coastal Act, has permit authority over project components in state waters and retains appeal authority over certain development and geographic areas in the onshore portion of the coastal zone. The California Coastal Act is administered by the CCC and establishes the foundation of the California Coastal Zone Management Program. The Coastal Act policies are discussed in Appendix B of this report. The CCC performs federal consistency review for all projects involving federal actions, including proposed development in federal waters or on federal lands, that may have direct effects on the coastal zone.

Any development within the coastal zone requires a Coastal Development Permit. Counties and cities with approved LCPs have permit jurisdiction from the mean high tide line to the coastal zone boundary which is generally 1000 yards inland. Therefore, facilities like a marine terminal require two CDPs, one from the CCC for portions of the project offshore in state waters and one from the county for onshore coastal zone facilities.

Regional Water Quality Control Board (RWQCB)

Platform wastewater discharge, ocean outfall, and hydrostatic testing discharges into state waters require a NPDES permit from the State Regional Water Quality Control Board. Permits are issued on a case by case basis for each proposed operation. The permits specifically prohibit the discharge of oil contaminated drilling muds or cuttings.

Other Relevant Regulations and Agencies

The California Department of Fish and Game requires permits for any stream bed alteration activities that will change the natural state of any stream or river. The Department of Transportation (CALTRANS) requires an Encroachment Permit for any activities (such as construction of a pipeline under a state highway) within the right-of-way of a state highway.

A.4 LOCAL CONTROL

While the state and federal governments both have direct management control over their respective offshore jurisdictions, local governments only have direct control over the permitting of onshore facilities such as processing plants, pipelines, supply bases, and marine terminals. Development in unincorporated county areas is regulated by a county's comprehensive general plan and zoning ordinances. A comprehensive plan has nine mandated elements, including open space, land use, circulation, and resource conservation elements. Development within the coastal zone is regulated by a local coastal program (LCP) which, as described earlier is prepared under the California Coastal Act by each local government and certified by the CCC. The Coastal Act requires coastal cities and counties to prepare LCPs outlining acceptable coastal development. An LCP usually consists of a land use plan, coastal zoning ordinance and zoning maps. The coastal zone usually extends from 3 miles offshore to one thousand yards inland from the mean high tide line. In areas of significant coastal habitat, the coastal zone may extend inland up to 5 miles. Full permit authority for coastal development in the coastal zone reverts to the local government once its complete LCP receives CCC certification. All six central coast counties have a certified LCP. The CCC hears appeals on some local coastal development permit (CDP) decisions and issues CDPs for those applications which, on appeal, are found to be consistent with the Act. Local governments also control air quality out to 3 miles offshore through local Air Pollution Control Districts (APCD).

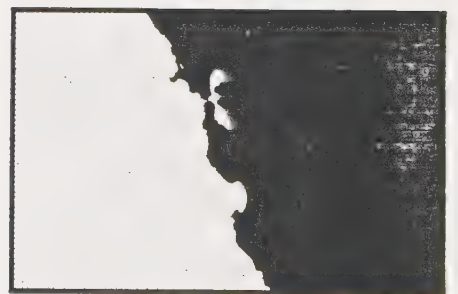
Local Government Initiatives

Table A-2 summarizes the initiatives which have been passed by five of the six central coast counties. Although each initiative is different, in general, the initiatives require voter approval before onshore facilities related to offshore oil and gas development are approved by the counties. The CCC has approved LCP amendments which incorporate the initiatives

Table A-2
SUMMARY OF LOCAL GOVERNMENT INITIATIVES

<u>County</u>	<u>Intent</u>	<u>Dated Passed</u>	Approved by <u>CCC</u>
Sonoma	Requires voter approval for LCP amendments which would allow onshore facilities for offshore oil and gas development	November 1986	No
San Francisco	Moratorium on specific oil-related facilities for a 2-year study period, recently extended for an additional year	November 1986	No
San Mateo	Prohibits onshore facilities related to oil development in the coastal zone and prohibits pipelines for oil and gas	November 1986	Yes
Santa Cruz	Requires voter approval for new major onshore oil and gas development	June 3, 1985	No
Monterey	Requires voter approval for onshore facilities related to offshore oil facilities exceeding 20,000 square feet	November 1986	No

into the LCP for San Mateo County only. The other counties have not yet received CCC approval. Until both the CCC and NOAA approve the amendments, the initiatives are not legally part of the state's federally approved program . Therefore, the initiatives would not be considered as part of the CZMA consistency review process, however if a CDP for activities in the study area were ever to be considered by the CCC, they would take the initiatives into consideration.



APPENDIX B

APPENDIX B

OVERVIEW OF COASTAL LAND USE CONDITIONS AND POLICIES

This Appendix provides background information on the coastal land use conditions and policies for the participating six central California coastal counties. Coastal land uses and policies are discussed for each county (Sonoma, Marin, San Francisco, San Mateo, Santa Cruz and Monterey) in the following sections.

B.1 COUNTY LAND USES AND POLICIES

Offshore oil related facilities such as OS&Ts, marine terminals, crew and supply bases, and offshore pipeline landfalls mainly impact coastal areas, while other facilities such as onshore pipelines and processing facilities can impact either coastal areas or inland areas, depending on where they are sited.

Although impacts can occur inland, the majority of ongoing impacts are expected to occur within the coastal zone. No processing facilities or onshore pipeline corridors exist in the study area; therefore, there is no financial incentive to build processing facilities inland near existing infrastructure. Onshore pipelines may be located through inland areas; however, impacts will be most significant along sensitive coastal habitats. Therefore, this chapter provides the reader with a general understanding of coastal land uses and local plans and policies within the Central Coast counties.

Large portions of the central California region are devoted to agriculture, natural resource protection, and recreation. North of San Francisco, the dominant land uses are: agriculture, fishing, and recreation. South of San Francisco, agriculture, recreation, and fishing dominate the coastal economy and land use. Many of the land areas along the coast of central California are protected from development (to various degrees) by federal, state, or local government ownership. Except for the San Francisco Bay area, there is little energy related development in the study area. All state waters off central California have been designated an oil and gas sanctuary which excludes oil and gas leasing in these areas. There is no restriction on the placement of OCS related pipelines through the sanctuaries.

As discussed earlier, the California Coastal Act required cities and counties within the coastal zone to prepare a local coastal program (LCP) and to bring their general plans and

zoning ordinances into conformity with statewide coastal policies. Once a LCP is certified by the CCC, it is legally binding on a local government and provides a permanent coastal protection program. The LCP is designed as a separate element to the county's general plan and consists of two parts: the land use plan (LUP) and the coastal zoning ordinance (CZO), along with zoning district maps. Each of the six Central Coast counties has a certified LCP.

Local governments were required to consider anticipated major energy facilities in the preparation of their LCPs. San Mateo County has a full energy component in their LCP; however, because no oil-related energy facilities exist in the region and none were anticipated, the other counties have limited specific direction for future energy facility siting in their LCPs.

If siting of new oil and gas facilities were to occur in the coastal zone, siting would be dependent upon such factors as the availability of suitable land, coastal development policies of the specific counties, and access to existing harbor facilities, roads, and other support infrastructure. An overview of each county's LCP, significant sensitive coastal resources, and recreational areas are provided below.¹ Please refer to Figures 8-1a, 8-1b, 8-2a, and 8-2b for specific locations of resources. A summary of Santa Barbara County's plans and policies is also provided to allow the reader to see the offshore oil and gas policies developed in Santa Barbara.

Sonoma County

The Sonoma County LCP was certified by the CCC in December 1980. The LCP covers an area which is 55 miles in length and extends inland generally 1000 yards.² Sonoma County has a rugged, rocky coast line shared in roughly equal proportions between vacation homes, public parks, and cattle grazing. State and county parkland account for about one-quarter of the land within the Sonoma County coastal zone, with almost half of the coastline in parks (Sonoma County 1981). Private recreational facilities only comprise 1 mile of coastline and 1 mile of Russian River frontage.

¹ Information on sensitive habitats was excerpted from the California Coastal Resource Guide 1987.

² In certain sensitive areas the coastal zone extends inland up to 5 miles. Sonoma County's coastal zone boundary is generally 3000 to 12,000 feet inland from shoreline, except around Duncans Mills, Willow Creek, and Valley Ford, where it extends up to 5 miles inland.

The northern third of the coast is mostly private land, with limited public access. The central third is largely in public ownership with 3 state parks and a county park providing access to the rocky coast. The southern third of the coast is mostly state beach; the Sonoma Coast State Beaches comprise over a dozen sandy coves between Goat Rock and Bodega Bay. The coastal zone economy is based on cattle and sheep raising, timber production, and tourism north of the Russian River, and dairy farming, fishing and tourism in the Bodega Bay area.

Environmentally sensitive habitats include: the mouths of the Gualala River, Russian River, Salmon Creek and Estero Americano, Del Mar Landing and Gerstle Cove Ecological Reserves, seabird rookeries, several rare and/or endangered plant sites, Fort Ross Creek, and Fort Ross State Historical Park. Steep cliffs dominate much of the coastline. At the southern portion of the coastal zone, Bodega Harbor is an area of high natural resource value, combined with commercial and sport fishing, recreation, and educational activities. Some of the key resources are highlighted below.

- Del Mar Landing Ecological Reserve

The offshore reserve extends about 3,000 feet south from Del Mar Point. It was established to protect the rocky intertidal zone, which provides habitat for such marine invertebrates as sea urchins, purple sea stars, California mussels, and black turban snails. Harbor seals often haul out on the offshore rocks. Pelagic cormorants nest in the vicinity of Del Mar Point.

- Salt Point State Park

Located on a marine terrace, Salt Point's more than 4000 acres encompasses many diverse habitats, and range from sea level to 1000 ft. elevation in the coastal hills. The coastline varies from sheltered, sandy coves such as Stump Beach to sharp bluffs and sheer sandstone cliffs at Salt Point and Gerstle Cove. The many tidepool areas along the 7 miles of coastline are relatively undisturbed and rich in marine life. The offshore waters are popular for diving, especially for abalone.

Wildlife within the park includes black-tailed deer, gray fox, badgers, feral pigs, pintail ducks, turkey vultures, gulls, terns, and brown pelicans. One of the best

locations in the state for observing the breeding behavior of pelagic cormorants is at Stump Beach.

- **Sonoma Coast Beaches**

Sonoma coast state beaches include Russian Gulch, North Jenner Beaches, Willow Creek, Penny Island, Goat Rock, Blind Beach, Shell Beach, Wright's Beach, Duncan's Landing, Duncan's Cove, Gleason Beach, Portuguese Beach, Schoolhouse Beach, Carmet Beach, Marshall Gulch, Arched Rock Beach, Coleman's Beach, Miwok Beach, North Salmon Creek Beach, South Salmon Creek Beach, Bodega Dunes, and Bodega Head.

The Sonoma coast state beaches encompass approximately 5000 acres, including 13 miles of coastline characterized by short stretches of sandy beach separated by rocky headlands. In spring, wildflowers such as lupine, Indian paintbrush, western wallflower, and wild strawberry bloom on the coastal bluffs; the endangered yellow larkspur is also found in the area. The diverse intertidal plant and animal communities make the Sonoma coast state beaches an important area.

Large offshore rocks such as Arched Rock (off Blind Beach) and Gull Rock (off Shell Beach) are nesting area for Brandt's cormorants, western gulls, and pigeon guillemots. The bluffs and upland grasslands provide habitat for raccoons, gray fox, rabbits, and black-tailed deer.

- **Bodega Bay and Harbor**

The only harbor along the Sonoma County coast is Bodega Bay Harbor. The harbor consists of approximately 840 acres and is shallow and edged with salt marshes and tidal flats (which occupy about 500 acres). Bodega Bay Harbor is the home of a major commercial fishing fleet with over 250 commercial vessels; existing dock and berthing facilities are limited. Existing facilities in support of commercial fishing include two berthing installations, three boat launching ramps, commercial fish receiving piers, and a federally-maintained navigation channel. Bodega Bay has been identified in the county LCP as the location where future coastal dependent industrial development should be directed. If development were to occur, Bodega Bay is a possible location for an onshore service base

because of its proximity to offshore structures. Existing county policy is to only support industrial activities which contribute to the commercial fishing, agriculture, and timber industries and to discourage industrial activities related to offshore oil and gas development.

Oil Initiative

In November 1986 an initiative was passed in Sonoma County which requires voter approval for LCP amendments which would allow onshore facilities for offshore oil and gas. The initiative also expresses strong citizen opposition to proposed OCS development.

Marin County

Marin County's coastal zone is divided into two units. Unit I consists of the southern portion of Marin's coastline, including Bolinas, Stinson Beach, and Muir Beach; Unit I's LCP was certified by the CCC in April 1980. Unit II covers an area from Olema north to the Sonoma County border, and the LCP was certified in April 1981.

Virtually all the lands within Unit I, with the exception of the communities of Muir Beach, Stinson Beach, and Bolinas, are in public ownership for recreational purposes; included are the Point Reyes National Seashore, Golden Gate National Recreation Area (GGNRA), Mount Tamalpais State Park, and several county parks. The major natural feature along the Unit II coast is Tomales Bay, a long narrow bay separating the Point Reyes peninsula from the coastal zone on the mainland. Landscape is characterized by open, rolling grasslands east of the bay and by wooded, steep terrain on the west side. The major land use is agriculture, primarily grazing and dairying.

Urban development in the coastal zone is confined to the communities of: Muir Beach, Bolinas, Stinson Beach, Olema, Point Reyes, Inverness, Marshall, Tomales, and Dillon Beach. Tomales Bay, Point Reyes National Seashore, GGNRA, and Tomales Bay State Park are the major open spaces in the county, offering magnificent scenery and a variety of recreational opportunities. The areas as described in the county's LCP and in the Final EIS for the Proposed Point Reyes - Farallon Island Marine Sanctuary, are discussed below.

- Point Reyes National Seashore/Golden Gate National Recreation Area

The federal Point Reyes National Seashore is the major public park in the Unit II coastal zone, offering magnificent scenery and a wide variety of low-intensity recreational uses. The park includes 65,300 acres or approximately 95 percent of all publicly owned land in Unit II. The park also has 30 miles of shoreline on the ocean and Tomales Bay, ten beaches, and 141 miles of trails. The park receives over 1.5 million visitors annually, 80 percent of whom utilize the beaches and 20 percent of whom utilize the trail system and hike-in camps. Point Reyes also displays a great diversity of wildlife and vegetation. The seashore ranks as one of the best bird watching and ornithological research areas in the United States (GGNRA 1980). About 750 plant species found on the peninsula are not found anywhere else. Most of Point Reyes is either legally designated as wilderness or is under lease or permit for grazing purposes.

The GGNRA extends into Marin County, where management objectives include maintaining the primitive and pastoral character of the parklands in northern Marin County by providing only minimum, dispersed development. Necessary developments are to be confined to the southern Marin County and San Francisco portions of the recreation area. Combined with Point Reyes, the GGNRA represents one of the nation's largest coastal preserves, more than 10,000 acres of North Pacific Coast landscape including headlands, grasslands, forests, lakes, streams, estuaries, and marshes.

- Tomales Bay

Tomales Bay is included in the Point Reyes-Farallones Marine Sanctuary and is designated a "Special Resource Area" by the CCC. Over 1000 species of invertebrates can be found in the bay (Marin County 1981). Habitat is also provided for birds and harbor seals.

In addition to the marine habitats, the bay includes approximately 440 acres of marsh and 2900 acres of mudflats which are valued as a wetland habitat, and for recreation, water, quality, and scientific and educational purposes. The wetlands also serve as corridors to spawning and nursery sites for anadromous fish, and

are used for recreational opportunities such as fishing, clamming, birdwatching, and photography.

- Tomales Bay State Park/Inverness Ridge Project

Tomales Bay State Park has offered day use opportunities to the public since its acquisition in 1952. The 1305 acre park has 3.5 miles of shoreline, four beaches, and 2.5 miles of trails. Swimming and clamming are the park's major attractions; the park's sandy beaches and protected coves offer ideal sites for these activities. Very often, when the ocean side of the Point Reyes National Seashore is fogbound, sunny sites can be found in Tomales Bay State Park. Annual visitation to the park is approximately 60,000 people.

- Tomales Bay Ecological Reserve

The Tomales Bay Ecological Reserve includes 500 acres of marsh with 1 mile of shoreline frontage. The reserve is located at the southern end of Tomales Bay at the outlet of Lagunitas Creek. It is owned by the Wildlife Conservation Board of the State Department of Fish and Game and managed as a wildlife reserve for migrating waterfowl and local fauna. Public access is possible in various places; however, recreational activities are limited to nature study, photography, birdwatching, and controlled hunting, in order to protect the habitat resources of the reserve.

- Estero Americano and Estero de San Antonio

These two esteros represent a major wetland area north of Tomales Bay. The esteros include more than 900 acres of wetland habitat. Animal life includes 71 species of water and marsh-related birds and 66 species of terrestrial birds. The esteros are important to migrating and wintering birds as well as year-round residents. Fish populations are equally diverse, with 31 marine and freshwater species (Marin County 1980).

- Duxbury Reef

Duxbury Reef has been designated a Marine Life Reserve and an ASBS; the reef is a 66-acre intertidal shale reef off the Bolinas Peninsula which supports large populations of marine organisms.

- Bolinas Lagoon

Bolinas Lagoon is a 1400-acre estuarine area 12 miles northwest of San Francisco Bay near Stinson Beach. This tidal lagoon opens out to Bolinas Bay and is composed of tidal flats, channels, salt marshes, and sandbars. The lagoon was designated as a Marin County Nature Preserve in 1977 due to the variety and sensitivity of habitats that are found there.

Tidal channels within the lagoon provide spawning, nursery, and feeding habitat for resident fish species and nonresidents which periodically enter the lagoon. Harbor seals use the lagoon channels for feeding and reaching their haul-out areas on the mudflats off Kent Island and Pickleweed Island (Marin County 1981).

Bolinas Lagoon and adjacent habitats support a large bird population. The salt marsh habitat found in the lagoon supports the endangered California clapper rail and rare black rail. Shorebirds, waterfowl, and gulls are the most abundant water birds at the lagoon.

Commercial Fishing and Mariculture

The Marin LCP includes a mariculture component, which provides for mariculture sites in Tomales Bay. Mariculture is the term used to describe saltwater or marine aquaculture (aquaculture is defined as the culture and husbandry of aquatic organisms). Currently there are seven oyster allotments and one mariculture lease on state lands in Tomales Bay. The allotments encompass about 105 acres of the bay's total water area (819 acres). About 100 acres are under active cultivation at this time. The State Department of Fish and Game recently released an additional 600 acres of the bay for mariculture. There are also three small oyster cultivation areas on private holdings and one within the Point Reyes National Seashore.

Mariculture also occurs in Drakes Bay where oyster production is a well-established business. Drakes Bay produces approximately 20 percent of California's entire commercial crop of oysters (State Department of Fish and Game 1988).

Tomales Bay is regularly used for both commercial fishing and recreational boating. The herring roe fishery is especially important in the bay. Most boating activities are limited to the bay itself, rather than the open ocean, due to strong winds and water action at the mouth of the bay. Currently, there are eight boat works, marinas, or launching facilities around Tomales Bay. These include the Golden Hinde Boatel, Inverness Yacht Club, and Berrywood Boat Works on the west side of the bay; Marconi Cove Marina, Marshall Boat Works, North Shore Boats, and Miller Park Boat Launch on the east side of the bay; and Lawson's Landing to the north of the bay. Together, these facilities offer approximately 120 seasonal and permanent boat slips or berths, dry storage for 160 boats, and 65 moorings.

Marin County Position on Offshore Oil

As summarized in the Unit II LCP, page 199, the Board of Supervisors formally testified in June 1980 before DOI in opposition to any federal leasing of OCS lands offshore Marin County. Reasons for this opposition include: low estimated petroleum yields, possible risks to the fragile coastline environment and economy, and inadequate environmental data upon which to base long-term policy decisions on resource exploitation.

San Francisco City and County

The San Francisco shoreline is a scenic and historic resource. The outstanding quality of the scenic, natural, and historic resources of the area dramatically contrasts with the intensively developed urban environment of the San Francisco metropolitan area. In the city, there is the lively Fisherman's Wharf and Golden Gate National Recreation Area waterfront just a short distance from isolated windswept cliffs and cypress groves. The wide variety of resources and outdoor settings has created a character unique to this area.

There is no single planning document available for the coastal zone in the City and County of San Francisco. The San Francisco City Planning Commission is responsible for adopting and maintaining a comprehensive long-term general plan for the future of the city

and county, known as the Master Plan. The plan is divided into a number of functional subareas including the northeastern waterfront, the central waterfront, south bayshore, and the western shoreline.

The San Francisco Planning Commission adopted a LCP and Western Shoreline Plan in 1980; the Western Shoreline Plan was amended and adopted as part of the city's Master Plan and certified by the CCC on March 17, 1986. The San Francisco coastal zone extends about 6 miles along the western shoreline from the Fort Funstan cliff area in the south to the Point Lobos recreational area in the north. The coastal zone spans the ocean beach shoreline and includes some of Golden Gate Park. Most of the San Francisco western shoreline is publicly owned. The significant public open spaces in the city include the Presidio, Golden Gate Park, Point Lobos, and GGNRA. The Presidio, under the jurisdiction of the U.S. Army and the National Park Service is important because of its historic value and because of its inclusion within the GGNRA. The Master Plan recommends much of this area be converted to open space. These areas are discussed below.

- Golden Gate National Recreation Area

The Golden Gate National Recreation Area (GGNRA) makes up 25 percent of the coastal zone. In San Francisco, the GGNRA includes notable areas such as Alcatraz Island, the Aquatic Park, Fort Mason, the Cliff House, the Presidio, and Ocean Beach.

- Northeastern Waterfront

The northeastern waterfront includes the Fisherman's Wharf area, the ferry building area, and the North China Basin area. The Northeastern Waterfront Plan recommends policies designed to contribute to the waterfront's environmental quality, enhance the economic vitality of the port and city, preserve the unique maritime character, and provide for maximum feasible visual and physical access to and along the bay.

- Central Waterfront

The central waterfront covers the eastern shoreline of San Francisco between China Basin and Islais Creek and adjacent inland areas. Industrial uses dominate the central waterfront; however, much of the industrial activity takes the form of low intensity distribution functions. Rail yards consume about one-third of the land. The Port of San Francisco has jurisdiction over the shoreline of the central waterfront area. Current maritime activities include several terminals and docks. The zoning of the central waterfront reflects its potential for accommodating high levels of industrial activity, nearly the entire area is zoned for heavy industry.

- South Bayshore

The south bayshore covers the southeastern section of the city from Islais Creek to the San Francisco/San Mateo County line. Over half the area is in industrial use, including private use, the Port of San Francisco's South Terminal, and the Hunters Point Naval Shipyard. One-fourth of the land is devoted to recreational and related uses and major recreational facilities include Candlestick Point State Recreational Area. Although a new physical look is emerging, overall the area has an industrial character to it.

Sensitive Natural Resources in San Francisco Bay Area

The San Francisco Bay and estuary area contains 90 percent of California's remaining coastal wetlands. The bay is an important stop on the Pacific flyway for millions of migrating waterfowl. Almost the entire California population of migrating northern shovelers winters in the bay, as do two-thirds of the state's canvasbacks and greater and lesser scaups. Even larger numbers of shorebirds inhabit bay marshes, particularly in the south bay where snowy plovers, black rails, and endangered California clapper rails nest. Endangered California least terns breed on the south bay's salt flats, and two subspecies of the endangered salt marsh harvest mouse inhabit the bay's salt and brackish water marshes.

Northern anchovy, Pacific herring, flatfish, and bay shrimp are common in the bay estuary, and soft-shelled clams and Japanese littleneck clams are abundant in east bay mudflats. However, the bay's historic salmon and steelhead trout fisheries have virtually disappeared due to loss of their ancestral spawning grounds to dams and water projects; the

once plentiful striped bass is also becoming scarce, and its flesh now contains high levels of mercury. The shrimp, mussels, and Dungeness crab that once supported lucrative fisheries are gone or too contaminated by industrial pollutants to be edible.

San Francisco Bay Conservation and Development Commission (BCDC)

The San Francisco Bay Conservation and Development Commission (BCDC) created in 1965 by state law, has developed the San Francisco Bay Plan, amended in 1979, to protect the bay and to provide development standards to minimize impacts to the bay. The plan covers the following areas:

- 1) San Francisco Bay;
- 2) A shoreline band consisting of all land located between the shoreline of the bay and 100 feet landward;
- 3) Managed wetlands; and
- 4) Selected waterways.

The San Francisco Bay Plan sets out policies to protect the bay as a natural resource and develop the bay and its shoreline to their highest potential with a minimum of bay filling. The San Francisco Special Area Plan was adopted by BCDC as an amendment to the bay plan in 1975. The special area plan serves as a guide concerning likely issuance of BCDC permits by showing what filling, dredging, or changes appear consistent with the bay plan. The special area plan, together with the bay plan, prescribe a set of rules for shoreline development along the San Francisco waterfront.

Several major ports and areas of water-related industry are located within the bay. The San Francisco Bay Area Seaport Plan, the regional port development plan for the area, does not contain any direct policies regarding oil and gas development activities.

Oil Initiative

The City and County of San Francisco passed a ballot measure in 1986 to put a moratorium on specific oil-related facilities for a 2-year study period, which was recently extended for 1 year. After the study, a decision will be made on what oil-related development, if any, is appropriate for the area.

San Mateo County

San Mateo County, situated along the central California coastline, encompasses the major portion of the San Francisco Peninsula. The county covers approximately 554 square miles, with land accounting for approximately 448 square miles and inland waters and San Francisco Bay tidal areas accounting for the remainder. The county is roughly 42 miles in length and varies from 7 to 20 miles in width. Approximately 55 miles of the county's western border is Pacific shoreline, and roughly 34 miles of the eastern border is bay shoreline. The county is bounded on the north by the City and County of San Francisco and on the south and southeast by Santa Cruz and Santa Clara counties.

The topography of the county is extremely varied. Elevation ranges from sea level to 2572 feet atop the Santa Cruz Mountains. This mountain range, running in a north-south direction, divides the county into two distinct regions, the bayside and the coastside. Much of the bayside consists of mudflats, marshes, artificial fill, and broad, flat alluvial plains. This level, low-lying region changes into gently rolling bayside foothills, increasing in slope to 15 to 30 percent. The San Andreas Fault parallels the Santa Cruz Mountain Range, demarcating the end of the bayside foothills and the beginning of the mountain range.

Coastside topography ranges from gently sloping foothills abutting the western face of the Santa Cruz Mountains to broad, nearly level coastal terraces. Small valleys created by streamflow appear throughout the foothills. Features along the shoreline range from wide, sandy beaches to rocky coves. Where wave action has eroded the coastal terraces, high, steep cliffs rise out of the ocean. The rural environment of the southern San Mateo coast contrasts sharply with the nearby bay area.

The LCP prohibits land uses or development that could potentially have adverse impacts on sensitive habitat areas. Implementation of this policy would eliminate all sensitive habitat areas as potential sites for oil-related development.

Key resources along the coast include: James V. Fitzgerald Marine Reserve, Half Moon Bay State Beaches, Pescadero Marsh Natural Preserve, and Año Nuevo State Reserve. These areas are briefly described below.

- **James V. Fitzgerald Marine Reserve**

Established in 1969, this reserve includes 3 miles of rocky coastline interspersed with sandy beaches. The reserve is a rich intertidal area. Extensive intertidal shale reefs provide habitat for abundant marine life such as giant green anemones, limpets, chitons, barnacles, spiny purple sea urchins, sea palms, surfgrass, feather boat kelp, and several species of crabs and snails.

- **Half Moon Bay State Beaches**

Beginning at East Breakwater, Half Moon Bay's shoreline gently curves southward and forms a long, sandy beach that is accessible at several points off Highway 1. The following beaches are within the Half Moon Bay State Beach system: Roosevelt Beach, Dunes Beach, Venice Beach, and Francis Beach, all of which provide restrooms and parking. Highly eroded bluffs and sand dunes with coastal strand vegetation, including cordgrass, seaside daisy, and introduced New Zealand spinach are typical of the area. Shorebirds feed and rest along the beaches.

- **Pescadero Marsh Natural Preserve**

East of Pescadero State Beach is a 510-acre protected wildlife sanctuary, which includes two large brackish ponds. Pescadero Marsh is a large coastal marsh, providing an important habitat for a variety of animals such as deer, raccoons, foxes, skunks, black-shouldered kites, yellow-throated warbler, Allen's hummingbirds, and overwintering dabbling and diving ducks. The San Francisco garter snake and peregrine falcon, both endangered species, also inhabit the area. In the hills above the marsh, large stands of eucalyptus provide roosts for great blue herons and snowy egrets. Over 180 species of birds, 50 species of mammals, 33 species of amphibians, and 380 species of plants have been sighted in the area.

- **Año Nuevo State Reserve**

Año Nuevo State Reserve encompasses 1200 acres of coastal bluffs, sandy beaches and dunes, and tidepools. California's largest population of Steller sea lions inhabit Año Nuevo Islands; elephant seals and harbor seals also breed here.

Pillar Point Harbor

Located just west of Princeton, Pillar Point is a granitic headland that shelters the only protected harbor between San Francisco and Santa Cruz. The town of Princeton, formerly known as Old Landing, is a commercial fishing and boat building center. Salmon, halibut, and kingfish are harvested commercially, and rockfish, starry flounder, and flatfish are caught at Johnson Pier.

Pillar Point Harbor is designated 50 percent commercial fishing and 50 percent recreational boating. LCP policies discourage any activities that would jeopardize sensitive habitats.

Onshore Facilities for Offshore Development

In late 1980, the CCC certified San Mateo County's LCP and in 1984 the LCP policies were amended. The energy component of the LCP includes policies for onshore facilities for offshore oil and suggests that onshore facilities should not be allowed within the coastal zone. When feasible, the LCP requires that pipelines be routed to avoid important coastal resources and that new pipeline corridors be consolidated within existing corridors. On November 4, 1986, the Measure A initiative passed which prohibits onshore facilities related to oil development in the coastal zone and prohibits pipelines for offshore oil and gas.

Santa Cruz County

Santa Cruz County, the second smallest county in California, contains a total of 282,240 acres located between the San Francisco Bay area and Monterey Peninsula. The economy of the county is diverse and includes commercial fishing, timber harvesting, gravel mining, agricultural and food processing services, and tourism. The county, which contains 42 miles of varied coastline, is an important vacation and recreational area.

Santa Cruz County's LCP was adopted by the County Board of Supervisors in 1981 as an element of the County General Plan and certified by the CCC in February 1982. The LCP was amended and certified by the CCC in 1985. Under industry and energy facilities policies, no sites are designated for heavy coastal-dependent industry and any proposed facilities would require an amendment to the LCP. Light industry is permitted only in existing industrial designated sites. The energy facilities policies require maximum consolidation of facilities.

The Santa Cruz LCP divides the county into four sub-areas: the North Coast, Bonny Doon, Mid County, and South County.

The majority of the North Coast area has been designated for agricultural uses; sensitive habitats are abundant and because several rare and endangered species exist in the area, much of the North Coast has been designated an area of biotic concern. Only two small parcels on the coast, owned by Lonestar Cement Company and Big Creek Lumber, are designated heavy industry.

North Coast beaches and parks include Waddell Creek Beach, Greyhound Rock Fishing Access, Scott Creek Beach and Big Basin Redwoods State Park. Important wetland estuaries are located at the mouths of Waddell and Scott Creeks.

The Bonny Doon area is mainly rural with much of the area devoted to agriculture. Like the North Coast, a large percentage of the area has been designated an area of biotic concern. Important wetland estuaries are located at the mouths of Laguna, Baldwin and Wilder Creeks. Bonny Doon beaches and parks include the Red, White and Blue Beach, Panther, 4-Mile, Bonny Doon, Natural Bridges State Beach and Wilder Ranch State Park.

The Mid County area is the most developed of the four Santa Cruz County sub-areas. Important wetland estuaries are located at Schwan Lake, Corcoran Lagoon and Moran Lake. Over a dozen beaches are located in the Mid County region, and many are very popular for coastal recreational use.

A large portion of the South County area is also designated as an area of biotic concern mainly due to wetland estuaries, including the Harkins and Watsonville Sloughs, and endangered Santa Cruz Long-Toed Salamander habitat. The South County area includes Trestle Beach, Manresa State Beach, Sunset State Beach, and Palm Beach.

Some of the state beaches and parks are briefly discussed below.

- Big Basin Redwoods State Park

The Big Basin Redwoods State Park was established in 1902 and is the oldest park in the California State Park system. Over 14,000 acres are included in this park which is probably most noted for its 38 mile long Skyline-to-Sea Hiking Trail which begins at Castle Rock State Park near Saratoga Gap in the Santa Cruz Mountains and ends at the ocean at Waddell Creek Beach.

- Natural Bridges State Beach

Natural Bridges State Beach encompasses 54 acres of sandy beach, tidepools, coastal bluffs, eucalyptus forest and creek. It was named for its natural bridge rock formations which are being eroded away by wave action and is well known for both its extensive tidepools and butterfly study area. The annual migration of the Monarch butterfly is from September through December.

- Seacliff State Beach

Seacliff State Beach is the northern limit of the Pismo Clam. This beach is famous for its fishing pier which leads to a 435 foot concrete supply ship, the Palo Alto, which was built during WWI. Although the ship is no longer accessible due to safety factors, the fishing pier is used extensively year-round.

- Wilder Ranch State Park

Wilder Ranch State Park includes over 4000 acres of extensive uplands, coastal terraces, streams, beaches, and offshore submerged lands. Wilder Beach contains the best preserved coastal strand and lagoon in the county, providing feeding and nesting site habitat for many birds. Inland areas provide important raptor wintering and nesting sites.

- Manresa State Beach

Manresa State Beach is a wide, sandy beach backed by steep cliffs. Sea otters can be seen swimming and feeding offshore. During migration, California gray whales can also be seen.

Santa Cruz Harbor

Santa Cruz Harbor is located within the City of Santa Cruz on the north shore of Monterey Bay. Much of Santa Cruz Harbor has already been developed and functions as a group of interdependent water-related activities. The harbor provides recreational, commercial, social, and economic benefits to the community; approximately 215 commercial fishing vessels and 700 recreational boats berth at the harbor.

Aquaculture

Currently there are three aquaculture facilities located in Santa Cruz County. They are Silver King Oceanic Farms, Pacific Mariculture, and the Monterey Bay Salmon and Trout Project. These are briefly discussed below:

- Silver King Oceanic Farms is located in Davenport, west of Highway 1 off Davenport Landing Road. The 8-acre facility includes a concrete fish ladder that extends into the ocean, a 2400-square foot concrete block building, two earthen ponds, saltwater intake lines, pumps, generators, and an access driveway. They are currently ocean ranching steelhead, chinook, and coho salmon, as well as farming Atlantic Salmon in circular tanks.
- Pacific Mariculture raises abalones and is currently located at Long Marine Laboratories. They plan to build a new facility in Davenport on Coast Road in the near future.
- The Monterey Bay Salmon and Trout Project is located on Big Creek. This hatchery is raising coho salmon and steelhead.

Oil Initiative

On June 3, 1986, the county citizens passed a referendum which requires voter approval for new major onshore facilities for offshore oil and gas developments. Any facility over 20,000 square feet intended to support offshore oil and gas development must be authorized by a majority vote of the qualified electors. The onshore ordinance implemented expresses strong opposition to offshore oil development. The City of Santa Cruz also passed a measure in 1985 which opposes offshore development.

Monterey County

The coastal zone of Monterey County is divided into four segments for planning purposes: The North County segment, Big Sur, Carmel, and Del Monte forest. The North County LCP was adopted by the Board of Supervisors in April 1982. The Big Sur LCP was certified in April 1986, the Carmel Area LCP was certified in October 1982, and the Del Monte Forest Area LCP was certified in September 1984. No Lease Sale 119 tracts are being offered directly off Monterey County and most impacts would be felt by the North County. The North County segment includes the unincorporated area of the coastal zone from the Marina City limits to the Santa Cruz County boundary. Agriculture is the main economic activity in the North County. Recreation and visitor facilities are concentrated in the vicinity of Moss Landing and along the sandy coastline. Recreation resources include miles of beaches and dunes, an extensive estuary and tidal wetland system, the Pajaro and Salinas rivers, and the wooded hills and ridges inland from the coast.

North County has a variety of valuable natural resources, including the Elkhorn Slough, one of California's principal remaining estuaries. Other estuarine areas in the North County include: Bennett Slough, McClusky Slough, Moro Cojo Slough, and the Old Salinas River Channel. Broad beaches, dunes, and wetlands also line the Monterey coast. Protection and effective management of these areas is a high priority for the county. The prime objective of the North County LCP is to plan for appropriate levels of development in the coastal zone while protecting coastal resources. In the North County, the coastal zone extends inland to the 5-mile legal limit to include as much as possible of the Elkhorn Slough. The majority of land in North County is in open space, agricultural, or low density rural residential use.

The Big Sur coastal segment is over 70 miles in length and stretches from the Carmel area on the north, south to San Luis Obispo County line near San Simeon. The region is very distinctive geographically, with the western slopes of the Santa Lucia Mountains reaching an elevation of 5200 feet, dropping to the sea; much of the coast is bounded by sheer cliffs. The scenic qualities and natural grandeur of the coast has helped Big Sur attain a world-wide reputation for its spectacular beauty and recreational activities.

The Carmel coastal segment, which extends from Pescadero Canyon in the north to Malpaso Creek in the south, supports a rich treasure of natural and cultural resources. Carmel Point's magnificent shoreline panoramas, the Carmel Mission Basilica, and Point Lobos State Reserve are a few of the most notable natural resources for which this area is famous. Development of the Carmel area has been limited by natural constraints and hazards such as rugged terrain, difficult access, and steep unstable slopes. The natural resources and the constraints of the land, in conjunction with the fact that no lease tracts are proposed off this segment of the coast, put this area at low risk to potential oil development facilities.

The Del Monte Forest area includes the Del Monte Forest, Shepherds Knoll planning area, and a portion of the U.S. Army Presidio. Environmentally sensitive habitats include freshwater marshes, intertidal areas on the rocky portion of the shoreline, kelp beds, Carmel Bay State Ecological Reserve, and Carmel Bay ASBS. The southern sea otter, the California brown pelican, and the California least tern are found in the area.

A number of research facilities are located within the Monterey Bay area including the Elkhorn Slough Estuarine Reserve, Moss Landing Marine Lab, Naval Postgraduate School, the Monterey Bay Aquarium, Hopkins Marine Station, and Granite Canyon Marine Lab. The key resources of the area are discussed briefly below.

- Moss Landing State Beach

Moss Landing State Beach, popular for surfing, is also called Jetty Beach because the North Jetty of Moss Landing Harbor marks the south end of the beach. The rock jetty provides a fishing access where anglers catch rockfish, flounder, sharks, surfperch, and sculpin. It is possible to walk or ride horses north along the sandy beach all the way to the mouth of the Pajaro River. Jetty Road which skirts Moss Landing's north harbor, is considered one of the best bird watching

spots in central California. During low tides, shorebirds, gulls, and terns congregate on exposed mudflats.

- Elkhorn Slough

One of the few relatively undisturbed coastal wetlands remaining in California, Elkhorn Slough is a tidal embayment that extends inland for over 7 miles from Moss Landing to Watsonville. This complex ecosystem comprises pasture and agricultural land, freshwater and brackish water marsh, salt ponds, grassland, riparian and oak woodland, and 2500 acres of tidelands that include mudflats and salt marsh; the slough area is used extensively for research, recreation, and education.

Elkhorn Slough supports nearly 260 species of birds and is an important link in the Pacific flyway. Tremendous numbers of birds congregate here during the peak of the migration season in winter and spring. At low tides, exposed mudflats run the length of the slough and provide a rich source of food for resident and migratory shorebirds and wading birds such as sandpipers, stilts, avocets, dowitchers, marbled godwits, willets, plovers, long-billed curlews, herons, and egrets. Waterfowl includes northern shovelers, green-winged teals, and cinnamon teals. The endangered California clapper rail, a permanent resident, is dependent on the perennial pickleweed that makes up almost all of the salt marsh vegetation.

In 1979, 900 acres on the south and east sides of Elkhorn Slough became the state's first National Estuarine Sanctuary (since renamed "National Estuarine Research Reserve"). Also a state ecological reserve, the area now comprises 1300 acres.

The North American record for the most species of birds (116) seen in one day from one spot was set here on the Five Fingers Loop Trail in 1982. The golden eagle and peregrine falcon, both endangered species, and the osprey and merlin are regularly seen here.

- Point Lobos State Reserve

Established in 1933, the 1300-acre state reserve encompasses a forested rocky headland, grassy meadows, sandy coves, tidepools, pebble beaches, a creek, and the underwater area surrounding the point. The reserve's 6-mile-long coastline is composed of granite and a sedimentary rock formation of sandstone and gravel called Carmelo conglomerate.

Point Lobos is maintained as a pristine area, and all plants, rocks, wood, sea shells, and animal life are protected.

- Moss Landing Area

The Moss Landing area includes Moss Landing State Beach, Moss Landing Harbor, and light and heavy industry. The Moss Landing Harbor provides a base for a strong commercial fishing industry; commercial fishing industries include canneries and fish processing companies, boat storage and repair facilities, and other related facilities. Demand for commercial and recreational boat berths far exceeds the available supply in the existing harbor area. Adjacent to the harbor is the Moss Landing Marine Lab.

Heavy industry in the area includes PG&E's power plant and Kaiser Refractories, which produce magnesia and refractory brick. PG&E owns a conventional buoy mooring marine terminal in Monterey Bay; the terminal receives fuel oil. Permitted land uses in the industrial land use category are limited to existing industry, including the PG&E Moss Landing facility and agriculturally related industry.

Aquaculture

Agriculture is a traditional coastal activity that contributes substantially to the region's economy, employment, and open space. In addition, aquaculture, the culture of aquatic plants and animals for human use, is a preferred use of appropriate coastal areas. A number of aquacultural enterprises are active in Moss Landing and the Elkhorn Slough. Existing aquaculture operations include Sea Life Supply at Elkhorn Slough and Pacific

Mariculture at Moss Landing. Three other operations are scattered along the coast near Monterey, Carmel, and Granite Canyon.

Oil Initiative

On November 4, 1986, Monterey County passed a referendum which requires voter approval for onshore facilities for offshore oil exceeding 20,000 square feet. In addition, the referendum requires a concurring vote from the public if a project requires a LCP amendment, before the Board of Supervisors can approve any onshore facilities for oil and gas development.

B.2 NATIONAL AND STATE MARINE SANCTUARIES

The purpose of the marine sanctuaries program is to identify areas that are distinctive for their conservation, recreational, ecological, or aesthetic values and to preserve and restore such areas by designating them as marine sanctuaries. The primary emphasis on the program is protection of resources. The Gulf of Farallones National Marine Sanctuary, formally The Point Reyes-Farallon Islands National Marine Sanctuary, consists of an area adjacent to the coast of California north and south of the Point Reyes Headlands, between Bodega Heads and Rocky Point and the Farallon Islands (see Figure 8-1a). The sanctuary includes Bodega Bay, but not Bodega Harbor. Cordell Banks, north of the Farallones, and Monterey Bay are being considered as future marine sanctuaries.

Hydrocarbon exploration, development, and production are prohibited in a marine sanctuary except that pipelines related to operations outside the sanctuary may be placed at a distance greater than 2 miles from the Farallon Islands, Bolinas Lagoon and ASBS where certified to have no significant effect on sanctuary resources.

As discussed earlier, the California oil and gas sanctuaries located within state waters and submerged lands are specifically excluded from oil and gas leasing under state law. Within the central California planning area, the sanctuary includes all tide and submerged lands in a 3-mile wide band off the County of Monterey north to the northern Sonoma County border. There is no restriction on the placement of OCS-related pipelines through the sanctuaries.

There are also three types of designated areas of special concern: 1) ecological reserves; 2) marine life refuges; and 3) Areas of Special Biological Significance (ASBS). These are legally defined with reserves and refuges controlled by California Department of Fish and Game. The purpose of the refuges and reserves is to reduce the abuse and waste of the state's tidepool resources by restricting general collecting of all animals living in tide pools and other areas between the high tide mark and 1000 feet below the low tide mark. ASBSs are also designed to protect intertidal and shallow subtidal areas, but are controlled by the California State Water Resources Control Board. These are areas containing biological communities of such extraordinary value that no acceptable risk of change in their environments as a result of human activities can be entertained. Discharges which have the potential to impact an ASBS are not allowed by the state; however, a pipeline could possibly be installed through an ASBS if construction activities would not adversely affect the resource. The State of California has designated 5 ecological reserves, 4 marine life refuges, and 15 areas of special biological significance in central California.

B.3. STATE PLANS AND POLICIES

California Coastal Act

On January 1, 1977, the California Coastal Act established a permanent coastal management program for California. The CCC administers the Coastal Act, is responsible for coastal permit review, and performs consistency reviews, as discussed in detail in Chapter 2. The CCC has delegated its permitting responsibility to each central coast county, which have the authority to issue coastal permits within the coastal zone area from the mean high tide inland, varying normally from less than 1000 yards in municipalities to five miles in sensitive areas. The CCC retains responsibility for reviewing projects in state tidelands, from mean high tide to 3 miles offshore. The California Coastal Act includes policies that govern energy development. The policies deal with proliferation of facilities, oil spillage, vessel traffic safety, safety hazards, visual and scenic quality, air quality, commercial fishing, archaeological resources, biological resources, seismic hazards, geologic hazards, water quality, noise, public access, cumulative impacts, and public welfare.

The CCC has identified the following issues as relevant to offshore development (CCC 1987):

- 1) Size and timing of OCS lease sales and resultant development.
- 2) Need for consolidation of onshore and offshore facilities.
- 3) Risks to offshore navigation from an increased number of platforms, exploratory rigs, and vessel activity.
- 4) Cumulative impacts relative to air quality, commercial fisheries, oil spills, scenic quality, marine resources, vessel traffic safety, and land resources.
- 5) Effects from disposal of drill muds and cuttings, formation waters, and other drilling wastes.
- 6) Transportation of oil by pipeline rather than by tanker to promote consolidation of facilities, reduce risks of oil spills, and reduce air quality impacts.
- 7) Protection of wetlands, waterfowl migration, and nesting areas.
- 8) Protection of commercial fishing and environmentally sensitive areas.
- 9) Socioeconomic impacts on local communities.
- 10) Adequacy of oil spill equipment, contingency plans, and training programs.
- 11) Onshore and offshore effects of air emissions from platforms and exploratory rigs and associated development.
- 12) Protection of visual and recreational resources.
- 13) Protection of archaeological resources.
- 14) Protection of marine and estuarine sanctuaries.

The CCC uses Chapter 3 of the Coastal Act as their standard of review for any development under their primary permit authority.³ Chapter 3 of the Coastal Act sets forth policies which regulate coastal energy facility planning and siting. It places the protection and preservation of the coastal zone environment as a high priority. The policies aim to assure the orderly, balanced utilization and conservation of coastal zone resources, taking into account the social and economic needs of the people of California.

Chapter 3 is divided up into 7 articles. The relevant articles are summarized below:

- Article 2: Establishes the public's right to access to the coast as an important element of the coastal management program. This article specifies that development shall not interfere with the public's right of access.
- Article 3: Addresses the environmental protection of coastal and water-oriented recreational uses as important uses within the coastal zone.
- Article 4: Addresses the environmental protection of coastal waters, streams, wetlands, estuaries, and lakes. It establishes several protective policies, including protection against the spillage and provision for containment and cleanup of crude oil, gas, petroleum products, or hazardous substances; protection of the commercial fishing industry and recreational boating; and controls on the construction of structures that could alter natural shoreline processes.
- Article 5: Specifies that certain types of land resources are to be protected; environmentally sensitive habitat areas, parks and recreation areas, agricultural land, timberlands, and paleontological resources are all allowed special protection from disruption associated with development within or adjacent to such areas.
- Article 6: Establishes provisions to address the location and design of development within the coastal zone. This article establishes the concept of consolidation of development and also provides for the protection of the scenic qualities of the coastal areas. This article also provides that coastal-dependent

³ The Coastal Act has a total of 10 chapters. Chapter 1 includes findings and declarations and general provisions (Section 3000); Chapter 2 is definitions (Section 30100); Chapter 3 covers coastal resource planning and management policies (Section 30150); Chapters 4 to 10 cover other miscellaneous issues such as state agencies and development controls.

developments have priority over other developments on or near the shoreline, and requires that coastal-related development be accommodated within reasonable proximity to the coastal-dependent uses they support.

- Article 7: Addresses industrial development. This article specifically addresses tanker facilities, oil and gas development, refineries and petrochemical facilities, and thermal electric generating plants. Section 30260 encourages the location of new or expanded coastal-dependent industrial facilities at existing sites, but allows for special consideration where they cannot otherwise be accommodated consistent with other policies of the Coastal Act.

B.4 SANTA BARBARA COUNTY PLANS AND POLICIES

Because Santa Barbara County has been faced with offshore oil and gas development projects for over 15 years, the county has developed numerous plans and policies to ensure that development occurs in a planned and orderly manner which minimizes environmental impacts. A review of Santa Barbara County plans and policies is pertinent to this study because Santa Barbara recently underwent a proliferation of offshore oil development and as a result had to make substantial modifications to their policies to control this growth.

Santa Barbara County's Local Coastal Program now includes very specific policies relating to onshore oil and gas processing facilities supporting offshore oil and gas development, as well as for marine terminals, pipelines, piers, and staging areas. Existing policies favor consolidation of onshore facilities and tanker terminals to avoid industrial proliferation in the coastal zone. As a general rule, crude oil must be shipped via pipeline if such a pipeline is found to be technically and economically feasible. Policy also favors no more than one additional modern consolidated marine terminal, which should avoid risk to environmentally sensitive areas.

The Santa Barbara County Coastal Zoning Ordinance includes a coastal-dependent industry designation for all existing energy facility sites. Most coastal energy-related activities are principally permitted uses in these designated areas.

Consolidation Policies

The County of Santa Barbara recently submitted a major amendment to its certified LCP and coastal zoning ordinance to require consolidation of oil and gas facilities. It was approved in May 1988 by the CCC (see LCP Policies 6-6A to 6-6G). The county's amendment provides for consolidation of onshore oil and gas processing facilities in an area between the City of Santa Barbara and Point Arguello which is known as the South Coast Consolidation Planning Area (SCCPA). The area has eight existing oil and gas processing sites. The amendments modified the existing LCP policy and ordinances in the SCCPA to require that all new processing be limited to two processing sites unless it is determined that a developer has vested rights to utilize an existing facility that is not in the two consolidation areas. In addition, the policies and ordinances require commingled processing; equitable, nondiscriminatory access; and abandonment proceedings.

Liquefied Petroleum Gas and Natural Gas Liquids Policies

Upon the Planning Commission's recommendation, the Santa Barbara County Board of Supervisors unanimously passed a resolution in July 1985 which prohibits truck transportation of liquefied petroleum gas (LPG) and natural gas liquids (NGL) destined for non local (outside the Tri-county area) markets after June 30, 1988. Currently, approximately 16 percent of all NGL produced locally is transported by pipeline. The remaining 84 percent is transported via tank trucks. As of April 1987 the blending of the gas byproduct with crude oil for pipeline shipment is the only alternative mode of transportation that has been developed.

Recently, the Board of Supervisors authorized the staff to conduct a comprehensive assessment of LPG/NGL transportation risks and effectiveness of various risk reduction measures. Staff formed a technical advisory and information committee comprised of government and industry representatives to aid in the assessment. The risk reduction assessment is anticipated to be completed in mid 1989.

North County Gas Facility Consolidation Policies

The North County consolidation policies have been addressed in conjunction with Unocal's preliminary and final development plan hearings on Point Pedernales. Unocal agreed to fund a county study to identify an environmentally preferable site in the north county for a

consolidated gas facility. The Battles Gas Plant in Unocal's application is considered an interim facility for gas production. A steering committee for the North County Facility Siting Study, made up of government and industry representatives, met to identify tasks and reach a consensus on the screening and siting criteria to be applied in the siting study process. From the application of this criteria, broad areas in the North County were excluded. The North County Facility Siting Study is scheduled to be completed in late 1989.

Pipeline Consolidation Policies

Santa Barbara County amended its Land Use Plan (LUP) and LCP to require new pipelines to use existing corridors when feasible. The amendment also requires pipelines to be common carrier and multiple-user in order to minimize the need for additional pipelines. Applicants must take into account the reasonable, foreseeable needs of other potential shippers in the design of their pipeline. A common carrier pipeline is a pipeline which must accept and transport all congruous stock without discrimination. A multiple user pipeline, on the other hand, is one that is shared under agreement between two or more companies.

Local Coastal Program Policies

Below are excerpts from Santa Barbara County's LCP policies for onshore oil facilities.

Policy 6-6A: If upper throughput limits exist in any new oil transportation system, the county shall, to the maximum extent feasible and legally permissible, assure equitable, pro-rata access for all shippers. Permits for oil transportation systems shall require the permittee to achieve the county's goals for consolidation. County shall retain continuing permit jurisdiction to assure that these goals are met. For the purposes of this plan, "shipper" shall refer to the entity in legal ownership of the oil to be transported.

Policy 6-6B: Except for facilities not directly related to oil and gas processing as referenced in Policy 6-11B (Marine Terminals), this policy applies to areas of the coastal zone that are outside the South Coast Consolidation Planning Area (SCCPA).

- Policy 6-6C:** Consolidation of oil and gas processing facilities in the South Coast Consolidation Planning Area: New oil and gas production from offshore reservoirs or zones shall be processed at facilities approved for consolidated processing to the maximum extent technically and environmentally feasible. Commingled processing shall be required to avoid or reduce project and cumulative impacts. Construction of new processing facilities at consolidated sites will be considered only if the Planning Commission determines that said facilities are not redundant.
- Policy 6-6D:** Consolidation of oil and gas processing sites in the South Coast Consolidation Planning Area: The oil and gas processing sites at Gaviota and Las Flores Canyon are designated as consolidated sites for processing oil and gas production from offshore reservoirs and zones. Any new oil and gas production from offshore reservoirs or zones that is processed within the SCCPA shall be processed at these two sites.
- Policy 6-6E:** Equitable, nondiscriminatory access to consolidated facilities and sites: Operators and owners of County-designated consolidated facilities and sites shall make their facilities and property available for commingled processing and consolidation of oil and gas facilities on an equitable and nondiscriminatory basis.
- Policy 6-6F:** Review of oil and gas facility permits: The Planning Commission shall review permits that are approved after August 12, 1985 for new or modified oil and gas facilities when throughput, averaged (arithmetic mean) over any twelve (12) consecutive months, does not exceed 3 percent of the facility's maximum permitted operating capacity.
- Policy 6-6G:** Review of South Coast Consolidation Policies: The County shall periodically review the South Coast Consolidation policies in view of new or updated information.
- Policy 6-7:** The sections of the Petroleum Ordinance, Ordinance No. 661, and "Statement of Policy Relative to the Location of Onshore Facilities" that address oil and gas processing facilities are hereby incorporated by reference in the LUP. The statement does not apply, however, to the

South Coast Consolidation Planning Area, which is defined in Policy 6-6B.

- Policy 6-8: If an onshore pipeline for transporting crude oil to refineries is determined to be technically and economically feasible, proposals for expansion, modification, or construction of new coastal dependent oil and gas processing facilities shall be conditioned to required transshipment of oil through the pipeline when constructed, unless such condition would not be feasible for a particular operator.
- Policy 6-9: Applicants for oil and gas processing facilities shall prepare and keep updated emergency response plans to deal with the potential consequences of hydrocarbon leaks or fires. These emergency response plans shall be approved by the County's Emergency Services Coordinator and Fire Department.
- Policy 6-11: If an onshore pipeline is determined to be feasible, existing marine terminals shall become, after a specific period, non conforming uses. Crude oil shall be transported by pipeline, unless the county makes the finding that transshipment of oil by pipeline is not feasible for a particular operator.



APPENDIX C

APPENDIX C

GLOSSARY, ABBREVIATIONS, AND ACRONYMS

Definitions presented in this glossary describe terms as they may be used in this report. The glossary is intended for general reference only; for detailed descriptions of technical or specialized terms, please use a reference book in the field of particular interest.

Anticline

An upfold or arch of stratified rock in which the beds or layers bend downward in opposite directions from the crest or axis of the fold.

API

American Petroleum Institute.

AQAP

Air Quality Attainment Plan.

Aquifer

The water-bearing portion of subsurface earth materials that yields or is capable of yielding useful quantities of water to wells.

Associated gas

Natural gas, occurring either as a gas cap in contact with and above an oil accumulation within the reservoir or in solution in the soil.

BACT

Best Available Control Technology.

Baseline

The existing characterization of an area under no-project conditions.

Basement rock

Rock in the earth's crust beneath all sedimentary rocks.

Basin

A depression in the earth's crust in which sedimentary materials accumulate or have accumulated, usually characterized by continuous deposition over long periods of time; a broad area of the earth beneath which the strata dip, usually from the sides toward the center.

Bathymetric

Of or relating to the measurement of depths of water in oceans, seas, and lakes.

Barrel (BBL)

A barrel of oil equals 42 gallons. The measure stems from the 19th century when oil was carried in wooden 50-gallon barrels that leaked an average of eight gallons during shipment and storage.

Benthic

Relating to or occurring at the bottom of a body of water, including the ocean.

Block

A geographical area having a square dimension of approximately 3 miles on a side (9 square miles, 23.2 m, or 5,760 acres, 2,331 hectares) on the California (Lambert) Plane Coordinate System and 5,693 acres (2,304 hectares) on the Universal Transverse Mercator System (used north of Point Conception and southwest of San Diego). It is used in official MMS protraction diagrams or leasing maps. (See Tract).

BLM

United States Department of Interior, Bureau of Land Management.

Bonus

Money paid by the lessee for the execution of an oil and gas lease.

Boom

Mechanical equipment used in response to an oil spill to contain the spill on the water's surface.

BOP

Blowout prevention.

BPD

Barrels per day.

CAAQS

California Ambient Air Quality Standards.

California Coastal Act of 1976

A law enacted by the California legislature in 1976 which regulates development within the coastal zone from the Oregon border to the border of Mexico. The policies of the act are aimed at protection and preservation of coastal environmental resources as well as the protection and promotion of public use and enjoyment of coastal resources. The Coastal Commission established under the act regulates development in the zone through a coastal permit process until local governments in the zone establish their local coastal programs (LCP's). The commission retains permit and appeal authority over certain areas and/or over certain types of development.

Cambrian

The oldest of the periods of the Paleozoic Era; also the system of strata deposited during that time (between 570 million and 500 million years ago).

CARB

California Air Resources Board.

Call for Information and Nominations

The Minerals Management Service formally requests nominations for those specific areas where oil companies are interested in leasing and where the state and other parties would have problems with development.

CCC

California Coastal Commission.

- CCMP**
California Coastal Management Program
- CDFG**
California Department of Fish and Game.
- CDWR**
California Department of Water Resources.
- CEQ**
Council on Environmental Quality.
- CEQA**
California Environmental Quality Act.
- CFR**
Code of Federal Regulations.
- Chip Rock**
An impermeable rock overlying an oil or gas reservoir that tends to prevent migration of fluids from the reservoir.
- Closure**
The maximum limit of possible area in which hydrocarbons could be trapped.
- CNEL**
Community Noise Equivalent Level.
- CO**
Carbon monoxide.
- COOD**
California Office of Offshore Development.
- CO_x**
Carbon oxides.
- Collocated Facilities**
Facilities treating different oil stream types placed in close proximity to one another.
- Commingling**
Mixing of hydrocarbons in common-carrier pipelines when one company's production facility is closer to another company's refinery than to its own, or vice versa; also is used to facilitate transportation or to blend oils for composition requirements.
- Completion**
Preparation of a development well or an exploratory well to produce oil and/or gas; also refers to a well that has been plugged and abandoned.

Condensate

Known sometimes as distillate. Liquid hydrocarbons produced with natural gas that are separated from the gas by conventional surface separations. Condensate generally has an API gravity of 50 to 120 degrees and is water-white, straw, or bluish in color.

Consolidated Facility

An approved site with appropriate zoning where oil and/or gas streams from various production areas are commingled and processed at a central processing facility or where several oil and gas processing facilities are collocated at the site.

Consolidation

Involves requiring offshore and/or onshore operators to minimize the areas used for offshore/onshore operations through multi-use, multi-company facilities.

Continental Shelf

A broad, gently sloping, shallow feature extending from the shore to the Continental Slope.

Cracking

A process carried out in a refinery reactor in which the large molecules in the charge stock are broken up into smaller, lower-boiling, stable hydrocarbon molecules, which leave the vessel as overhead (unfinished cracked gasoline, kerosines, and gas oils). At the same time, certain of the unstable or reactive molecules in the charge stock combine to form tar or coke bottoms. The cracking reaction may be carried out with heat and pressure (thermal cracking) or in the presence of a catalyst (catalytic cracking).

Cumulative Impacts

The impacts on the environment which result from the incremental impacts of the past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individual minor but collectively significant actions taking place over a period of time.

Cut

Volume of water in crude petroleum expressed as a percent of the total volume of liquid (e.g., 100 bbls. of crude oil containing 15 bbls. of water = 15 percent cut).

CZMA (Coastal Zone Management Act)

A federal law enacted in 1972 to "protect, preserve, develop and, where possible, restore, or enhance the resources of the nation's coastal zone," through encouragement and assistance to states and through state participation in decisions affecting the coastal zone. The states establish coastal management programs subject to federal review and approval which outline principles for development and protection. It is stipulated that federal actions will be consistent with State Coastal Management Plans to the maximum extent practicable. Applicants for federal licenses and permits must submit consistency certifications. A 1976 amendment provides that OCS lessees must submit a consistency certification on exploration and development and production plans for state review and concurrence. An objection can be appealed to the Secretary of Commerce.

Decibel (dB)

A logarithmic unit of measure of sound pressure level used to describe the loudness of sound. When used to correspond to the human range of hearing, decibels are weighted on an A-scale and expressed as dBA.

Deep Stratigraphic Test Well (DST)

A well drilled to gather information about the stratigraphic formation present, the general character of the rocks, their porosity, and their permeability.

Degrees API Gravity

A measure of oil density and, to some extent, viscosity. The higher the degrees API gravity the lower the viscosity and specific gravity/density.

DEIR/S

Draft Environmental Impact Report/Statement.

Delineation Well

An exploratory well drilled subsequent to the discovery well that further defines the areal extent and other physical characteristics of a field.

Design Basis Accident (DBA)

An accident illustrative of the scope, type, and severity of accidents that could occur, based on historical data at similar sites, at the facilities.

Development

Activities that take place following exploration for, discovery of, and delineation of minerals in commercially recoverable quantities (including but not limited to geophysical activity, drilling, platform construction, placement, and operation of all directly related onshore support facilities) that are for the purpose of ultimately producing the minerals discovered.

Development and Production Plan (DPP)

A plan describing the specific work to be performed on an offshore lease or leases, including all development and production activities that the lessee proposes to undertake during the time period covered by the plan and all actions to be undertaken up to and including the commencement of sustained production. The plan also includes descriptions of facilities and operations to be used; well locations; current geological and geophysical information; environmental safeguards; safety standards and features; time schedules; and other relevant information. Lease operators formulate and obtain approval of such plans by the State Lands Commission before development and production activities begin in state waters.

Direct Effects

Effects resulting solely from project implementation. Direct effects are caused by the proposed actions and occur at the same time and place.

Direct Jobs

Relates to employees of the applicant (or its contractors), their payrolls, and the materials and services expenditures associated with the construction and operation phases of the proposed project.

Direct Support Jobs

Relates to support workers needed to provide direct services during the construction and operation phases of the proposed project. These services include transportation (e.g., helicopter pilots), service and repair, diving, equipment lease, and other services.

Discovery

The initial find of significant quantities of hydrocarbons.

Dome

A roughly symmetrical upfold, the beds dipping in all directions, more or less equally, from a point; any structural deformation characterized by local uplift approximately circular in outline (for example, the salt domes of Louisiana and Texas).

Drainage Sale

A lease sale held to protect either federal or state acreage from drainage by development on nearby blocks in the other jurisdiction.

Drill Cuttings

Chips and small fragments of rock as the result of drilling that are brought to the surface by the flow of the drilling mud as it is circulated.

Drill Muds

A special mixture of clay, water or refined oil, and chemical additives pumped downhole through the drill pipe and drill bit. The mud cools the rapidly rotating bit; lubricates the drill pipe as it turns in the well bore; carries rock cuttings (solid materials removed from drill hole) to the surface; serves as a plaster to prevent the wall of the bore hole from crumbling or collapsing; provides the weight or hydrostatic head to prevent extraneous fluids from entering the well bore; and controls downhole pressures that may be encountered.

Drillship

A self-propelled, self-contained vessel equipped with a derrick amidships for drilling wells in deep water.

Dry Oil

Crude oil that has been treated to reduce the cut of water to pipeline specification (usually between 1 and 3 percent).

DWT

Deadweight ton.

Emulsion

Mixture of crude oil and water remaining after free water has dropped out.

Endangered Species

A species that is threatened with extinction throughout all or a significant portion of its range.

Environmental Assessment (EA)

A document from MMS which provides sufficient evidence and analysis for determining whether to prepare an EIS or FONSI.

Environmental Impact Report (EIR)

A report required by the California Environmental Quality Act in response to any action significantly affecting the environment.

Environmental Impact Statement (EIS)

A report required by the National Environmental Policy Act of 1969 in response to any action significantly affecting the environment.

EPA

United States Environmental Protection Agency.

ESH

Environmentally Sensitive Habitat.

Exclusive Economic Zone (EEZ)

A zone contiguous to the territorial sea, including zones contiguous to the territorial sea of the United States, Puerto Rico, the Northern Mariana Islands, and U.S. overseas territories and possessions. Within the EEZ, the United States has, to the extent permitted by international law, (1) sovereign rights for the purpose of exploring, exploiting, conserving, and managing natural resources, both living and nonliving, of the sea bed and subsoil and the superjacent waters and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents, and winds; and (2) jurisdiction with regard to the establishment and use of artificial islands and installations and structures having economic purposes and the protection and preservation of the marine environment.

Exploration

The process of searching for minerals. Exploration activities include (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the geologic conditions conducive to the accumulation of such minerals and (2) any drilling, except development drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling of any additional well after such a discovery that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

Exploratory Rigs

Vessels used for offshore oil and gas exploration. They can be a drill ship which is a self-propelled, self-contained vessel equipped with a derrick amidships for drilling wells in deep water; a jackup rig that is a bargelike, floating platform with legs that can be lowered to the sea bottom to raise the decks above water; or a semisubmersible which is a drilling rig mounted on an offshore bargelike vessel whose hull is submerged by flooding its compartments, leaving the derrick and its equipment above the water line.

°F

Degrees Fahrenheit.

Fault

A fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.

Field

An area within which hydrocarbons have been concentrated and tapped in economically producible quantities in one or more structural or stratigraphically related reservoirs.

Fixed Berth

A pier built out into deep water for tankers at a marine terminal.

Flare System

A system to burn gas for the purpose of safe disposal.

FONSI

A finding of no significant impacts (FONSI) is a document by MMS which presents the reasons why a project will not have a significant effect on the human environment and for which an EIS will not be prepared.

Fracture Reservoir

A reservoir whose permeability is dependent on the breaking or shattering of an otherwise less pervious rock.

Fracture Zone

On the deep sea floor, an elongated zone of unusual irregular topography that often separates regions of different depths. Such a zone often crosses and apparently displaces the mid-oceanic ridge by faulting.

Free Water

Water that will separate out of crude oil without external stimulus (heat, chemical, and power).

Free Water Knockout Vessel (FWKV)

A piece of equipment that separates freewater (and gas) from the oil/water emulsion.

ft

Feet.

Future Baseline

A forecast of conditions most likely to exist at a future time assuming no exceptional changes occur within the socioeconomic environment.

FY

Fiscal Year.

g

Gram.

Gas

A light hydrocarbon gas mixture consisting chiefly of methane, i.e., natural gas.

Gas Oil Ratio (GOR)

Produced gas volume and net oil (after water removed) volume expressed as a ratio (gas volume/oil volume; usually c.f. gas/bbl oil).

Geologic Hazard

A feature or condition that may seriously jeopardize offshore oil and gas exploration and development activities. It may necessitate special engineering procedures or relocation of the proposed development.

GPD

Gallons per day.

Group Separator

A vessel with control accessories that separates and measures the different components of production from all wells in a group except the well on test.

ha

Hectare; one hectare is equal to 2.47 acres.

Hazard Footprint

Designates the distance from an accident within which specified types of injury to persons or damage to facilities could occur.

Heat Exchanger

A vessel in which heat is transferred from a hot fluid to a colder fluid through the walls of pipes which separate the fluids in flow through the vessel.

hp

Horsepower.

Hydrocarbon

Any of a large class of organic compounds containing primarily carbon and hydrogen, comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons, commonly referred to as petroleum, natural gas, coal, and bitumens.

H₂S

Hydrogen sulfide, a colorless, transparent gas with a characteristic rotten-egg smell. This can be lethal for short-term exposure to concentrations above 500 ppm and is extremely irritating above 150 ppm. Exposure to concentrations of 170 to 300 ppm for one hour usually has serious physiological consequences.

Impact

An assessment of the changes in the physical or human environment.

Indirect Effect

Effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Jacket

A supporting structure for an offshore platform consisting of large diameter pipe welded together with pipe braces to form a multilegged stool-like structure. The jacket is secured to the ocean floor by pilings driven through the legs.

Jack-Up Rig

A mobile drilling platform with extendible legs for support on the ocean floor.

LACT

Lease Automatic Custody Transfer; a metering facility for ownership transfer.

Landfall

The site at which a marine pipeline comes to shore.

Land Use

The function for which people employ an area of land.

Lay Barge

A barge used to lay underwater pipelines.

Lease

A contract authorizing exploration for a development and production of minerals; the land covered by such a contract.

Lease Sale

The public opening of sealed bids made after competitive submittal for lease granting companies or individuals the right to explore for and develop certain minerals within a defined period of time.

Lease Term

For oil and gas leases in California, a period of 20 years, or as long as the lease tract produces oil and gas.

Local Coastal Program (LCP)

Individual county and city coastal programs mandated by the California Coastal Act of 1976, each consisting of a land-use plan and implementation ordinances.

LPG

Liquid Propane Gas.

LUE

Land Use Element.

LUO

Land Use Ordinance.

Marine Sanctuary

Areas protected under the Marine Protection, Research, and Sanctuaries Act of 1972.

MBD, MBPD

Thousand barrels per day.

Ministerial Permits

Permits which involve little or no personal judgement. The public official merely applies the law to the facts as presented. Ministerial permits are usually issued by the local government staff rather than the Planning Commission.

MMBD

Million barrels per day.

MMS

United States Department of Interior, Minerals Management Service.

MMSCFD

Million standard cubic feet per day.

Multiple Buoy Mooring

Three to seven moored buoys for mooring tankers depending on ship size and environmental conditions. The buoys are placed in position off the ship's stern. The ship's anchors are used for forward mooring points. Submerged hoses attached to the subsea pipelines are connected to the tanker once it is moored.

NAAQS

National Ambient Air Quality Standards.

NGL (Natural Gas Liquids)

Natural gas liquids which are gaseous at underground reservoir temperatures and pressures but are recoverable by condensation or absorption.

NO_x (Nitrogen Oxides)

Nitrogen oxides: Compounds of nitrogen and oxygen which may be produced by the burning of fossil fuels. They are harmful to health and a contributor to formation of smog.

NOAA

National Oceanic and Atmospheric Administration.

Nonassociated Gas

Natural gas that is not associated with or not in contact with crude oil within a reservoir.

Nose

A half-developed anticline, that is, an anticline in which one end is open and without closure; also, the forward part of a turbidity current, which is more dense than the tail and carries coarser material.

NPDES

National Pollutant Discharge Elimination System.

Outer Continental Shelf (OCS)

All submerged lands lying seaward of the state tidelands. Jurisdiction and control over these lands were asserted in 1945 by President Truman. The Truman Proclamations, as they are called, were incorporated into domestic law by enactment of Congress in 1953 of the Submerged Lands Act (67 Stat. 29) and the Outer Continental Shelf Lands Act (67 Stat. 462).

OCS Lands Act (OCSLA)

A federal law enacted in 1953 which gave primary control to the federal government of submerged lands beyond the 3-mile limit of the territorial sea. The act was

amended in 1978 to require the Secretary of Interior to select the size, timing, and location of lease sales in a manner that balances the potential for oil discovery and adverse impacts on the coastal zone.

OCS Orders

Orders issued by the MMS for each OCS area. These orders govern oil and gas lease operations and specify procedures and practices that are required by the MMS during exploration and development and production activities.

Offshore Storage and Treatment Vessel (OS&T)

A converted tanker anchored near a platform and used to remove natural gas, water, and other impurities from crude oil and to store the treated product until it is unloaded by a shuttle vessel. There is one OS&T in federal waters near Platform Hondo off the Gaviota coast, Santa Barbara County.

Oil Spill Contingency Plan

A plan submitted by the oil/gas operator along with or prior to a submission of a plan of exploration or a plan of development that details provisions for fully defined, specific actions to be taken following discovery and notification of an oil spill.

OTP

Oil Transportation Plan.

Pay

The subsurface geological formation in which a deposit of oil or gas is found in commercial quantities.

Petroleum

An oily, flammable, bituminous liquid that occurs in many places in the upper strata of the earth, either in seepages or in reservoirs; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances (as natural gas or shale oil) similar in composition to petroleum.

Pigging

A process whereby pipelines are wiped clean of waxy, asphaltic, and sludge buildup associated with crude oils by plumbing a close fitting plug or "pig" through the pipeline. The plug is inserted into the line by a pig launcher and removed by a pig catcher. Pigs can also be used to inspect pipelines of corrosion and structural integrity.

Plankton

Tiny floating or swimming animal and plant life carried by the currents in a body of water.

Plan of Exploration (POE)

Plan based on all available relevant information about a leased area that identifies, to the maximum extent possible, all the potential hydrocarbon accumulations and wells that the lessee proposes to drill to evaluate the accumulations within the entire area of the leases covered by the plan. All lease operators are required to formulate and

obtain approval of such plans by the State Lands Commission before exploration activities can commence in state waters.

Planning Area(s)

Geographical area designated by the MMS for potential lease sale offerings.

Platform

A fixed steel or concrete structure from which offshore development wells are drilled and produced oil/gas/water is processed. It consists of a jacket or welded frame which is positioned almost totally underwater and attached to the ocean floor with piles driven through hollow legs. The deck section where drilling activities occur is welded to the top of the jacket.

PM

Particulate matter.

PM-10

Particulate matter less than 10 microns in size.

PRC

Public Resource Code.

PRESTO

Probabilistic resource estimates - OCS.

Primary Impacts

Impacts due to direct influences from project activities.

Processing

In this study, oil processing refers to dewatering and not to petroleum refining.

Production

Activities that take place after the successful establishment of means for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and workover drilling.

Production Curve

A curve plotted to show the relation between quantities produced during definite consecutive time intervals.

Recovery Factor

Amount of oil-in-place which can be produced. Every oil field has a different recovery factor.

Refinery

A plant for heating crude oil so that it separates into chemical components which are then distilled off as more usable substances, i.e., gasoline, kerosene, fuel oil, propane, lubricants.

Reserve Estimate

An assessment of the portion of the identified oil or gas resource that can be economically extracted.

Reserves

Portion of the identified oil or gas resource that can be economically extracted.

Reservoir

A subsurface, porous, permeable rock body in which oil or gas or both have accumulated.

Reservoir Rock

The rocks in which producible hydrocarbons accumulate, or whose characteristics are conducive to hydrocarbon accumulation and production.

Revenue Sharing

A proposed system of sharing with coastal states certain federal revenues generated by hydrocarbon development on the Outer Continental Shelf.

RHC

Photochemically reactive hydrocarbons.

Rig

Equipment used for drilling an oil or gas well (see also Platform).

ROW

Right-of-way.

Royalty

Income that the State Lands Commission receives on hydrocarbon produced in state waters.

Scrubber

A device for removing impurities especially from gas. Scrubbers are used to reduce air pollutants.

Sea Island

An offshore pier for tankers consisting of a platform with loading and/or unloading facilities connected to shore by subsea pipelines.

Segregated Facility

Facility at which various oil streams are processed and metered separately.

Seismic

Pertaining to, characteristic of, or produced by earthquakes or earth vibration; having to do with elastic waves in the earth.

Semi-submersible Drilling Unit

A vessel used for drilling hydrocarbon wells in deep water. The vessel is moved to the site via a combination of self propulsion and sea-going tugs. It is positioned over the well by partially submerging the vessel and then anchoring to the sea floor.

Separation and Treatment Facilities

Facilities that separate oil and/or gas from produced water, remove natural gasolines from gas, and remove sulfur from crude oil or natural gas.

Significance

Significant effect on the environment means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant (CEQA Section 15382).

Single Anchor Leg Mooring (SALM)

A semi-rigid anchored mooring used by vessels, primarily tankers, as a system to transfer oil to or from storage tanks or production platforms. The mooring buoy at the sea surface is attached to a mooring base anchored to the sea floor. Tankers are connected to it by mooring lines. Submarine pipelines are connected to the base from where hoses connect to the tanker.

Single Buoy Mooring

A mooring system using one buoy and commonly used for mooring large crude carriers. Two common types are CALM (catenary anchor-leg mooring) and SALM (single anchor leg mooring). (see SALM definition).

Site-specific

Characteristic of a geographically defined location that may vary considerably from characteristics of adjacent locations or the characteristics of a larger area within which the location in question is contained.

Skimmer

Mechanical equipment used in response to an oil spill to recover the oil and pump it to storage devices for transport away from the area.

SLC

State Lands Commission.

Slot

A guide on a drilling platform through which a well is drilled.

SO₂

Sulfur dioxide.

SO_x

Sulfur oxides.

Sour Crude

Crude oil containing acidic impurities, such as hydrogen sulfide, sulfur dioxide, and carbon dioxide.

Sour Gas

Natural gas containing acidic impurities, primarily hydrogen sulfide.

Source Bed

Rocks containing relatively large amounts of organic matter that are transformed into hydrocarbons.

Spud

To start the actual drilling of a well.

Stratigraphy

Origin, distribution, and composition of layers of earth and rock.

Stratum (pl., Strata)

A single sedimentary bed or layer, regardless of thickness; a section of a formation that consists throughout of approximately the same kind of rock material.

Structure

A geologic feature where hydrocarbons have accumulated.

Study Region

The largest region which would be expected to receive measurable impacts from the proposed project or action as defined by resource topic.

Submerged Lands Act

A federal law enacted in 1953 which gave primary control over the submerged lands of the coastal waters out to 3-miles to the states.

Subsea Completion

A production well in which the Christmas tree assembly is located at or near the ocean bottom rather than on a platform. The produced liquids or gases are then transferred from the well head either to a nearby fixed platform or to a shore facility for processing.

Supply Boat

Vessel that ferries people, food, water, drilling supplies, and equipment to a platform and returns to land with refuse that cannot be disposed of at sea.

Sweet Gas

Gas which contains no H₂S or only trace amounts which do not require removal for commercial use.

THC

Total hydrocarbons.

Threatened Species

A species that is likely to become endangered in the foreseeable future.

Tidelands

The portion of the Continental Shelf between the shore and the boundaries claimed by the states.

Tract

An areal unit usually consisting of a single block from an official protraction diagram. Groups of tracts, having sale-specific numbers, were selected and offered for lease prior to implementation of areawide leasing. Through Lease Sale 80, this was an identification number assigned to a block for a particular lease sale. In the future, MMS will not use tract numbers. (see Block).

Trap

A geologic feature that permits the accumulation and prevents the escape of accumulated fluids (hydrocarbons) from the reservoir.

Treatment Facility

A facility that removes impurities, separates hydrocarbons from water, emulsions, and other impurities, and further separates the liquid and gaseous hydrocarbons.

TSP

Total suspended particulates.

Undiscovered Resource

Quantities of oil and gas estimated to exist outside known fields.

Unit

A formally agreed-to consolidation by all lease interest owners whereby one operator explores, develops, and/or produces the leaseholdings for purposes of conservation, elimination of duplicate operations, and for maximization of hydrocarbon recovery.

Unitization

A process by which two or more leaseholders allow one company to serve as the operator for exploration, development, and/or production of the affected leases.

USGS

United States Geological Survey.

Viscosity

The measure of resistance of fluid to flow; highly viscous fluids are hard to move through a pipeline.

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